TECHNICAL REPORT

Sea ice reports for the Antarctic shipping season 2018 - 2019

ANTARCTIC GATEWAY PARTNERSHIP

A Special Research Initiative of the Australian Research Council

Prepared by Dr Jan L Lieser

ACE CRC

ANTARCTIC CLIMATE & ECOSYSTEMS CRC

Sea ice reports for the Antarctic shipping season 2018–2019

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This research was also supported under Australian Research Council's Special Research Initiative for Antarctic Gateway Partnership (Project ID SR140300001).

Executive summary

The sea-ice reports compiled in this document are weekly reports on sea-ice conditions for East Antarctica, including sub-weekly updates. They were prepared to support ship operations in East Antarctica during the 2018/2019 shipping season. These reports were primarily used to inform the Australian Antarctic program, but were provided to other Antarctic operators as well. In particular, we assisted the US National Science Foundation (RVIB *Nathaniel B. Palmer*), Royal New Zealand Navy (HMNZS *Otago*), the French Southern and Antarctic Lands Administration (OPV *l'Astrolabe*), New Zealand's National Institute of Water and Atmospheric Research (RV *Tangaroa*), and the Australian Marine National Facility (RV *Investigator*).

Throughout the shipping season, the focus of individual reports shifts with the main purpose of specific voyages of the Australian Antarctic research and supply vessel *Aurora Australis* and other customer requirements. The Antarctic voyages of RSV *Aurora Australis* in the 2018/2019 season were:

No.	Depart port	Main Purpose	Return to port
V1	25/10/2018	Davis Station resupply	28/11/2018
V2	06/12/2018	Casey Station resupply	07/01/2019
V3	13/01/2019	Mawson Station resupply; Davis summer retrieval	01/03/2019

In 2018, the trend of generally low sea-ice extent and area (relative to the long-term, satellite-based record) continued around Antarctica, while the actual basin-scale anomalies varied. The Weddell Sea and western Ross Sea experienced a shortened sea-ice season (number of days with sea-ice cover in a given area), which previously were regions of lengthened season. Only a small region of the offshore Bellingshausen Sea and eastern Amundsen Sea did show a slightly longer sea-ice season, which again is in contrast to the previous trend. In East Antarctica, only a minor area of slightly longer season is offshore Enderby Land. Elsewhere around the continent, a shortened season of locally more than 60 days was prevalent.

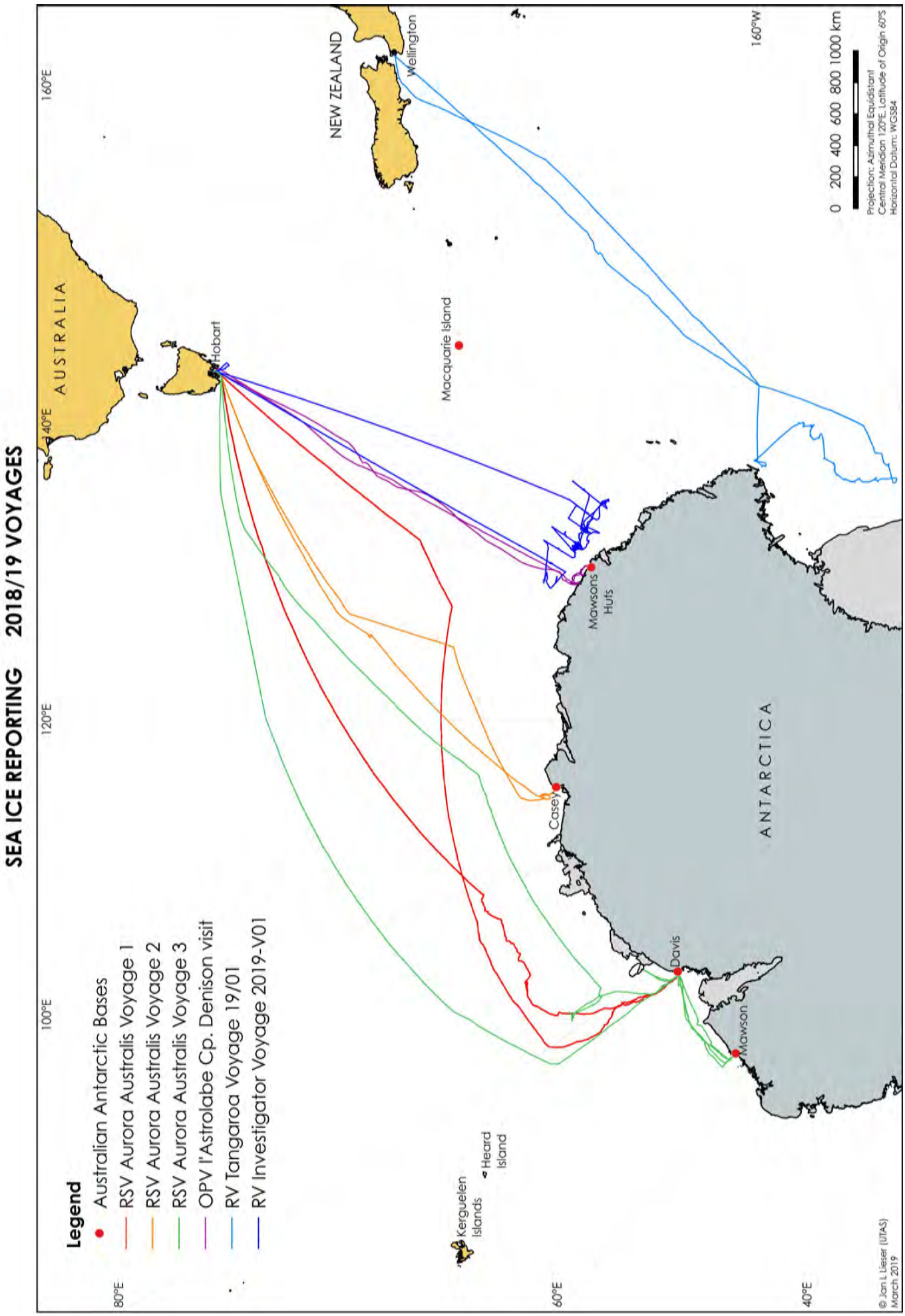
The annual sea-ice extent minimum was 2.15×10^6 km^2 and observed on 18/02/2018. This was slightly up (roughly 4%) from the record low of 2017. The annual sea-ice extent maximum was 18.22×10^6 km^2 and observed on 30/09/2018, which was marginally up (roughly 1%) from the previous year as well.

Notable new large, tabular icebergs calved off the West Ice Shelf (D-27 in February), the Ninnis Ice Shelf (C-35 in July), the Crosson Ice Shelf (B-45 in August) and the Pine Island Glacier (B-46 in October). Furthermore, an unusually high number of decaying icebergs (disintegrating into swarms of small bergs) was observed in the southwest Atlantic Ocean with individual bergs drifting as far north as 35° S (off the coast of Buenos Aires).

About this report

This compilation is the eighth volume of sea-ice reports prepared by the University of Tasmania's Sea Ice Service, which is supported by the Australian Research Council's Special Research Initiative for Antarctic Gateway Partnership and by the sea-ice group of the Antarctic Climate & Ecosystems Cooperative Research Centre and the Australian Antarctic Division. The first report of this compilation was issued in calendar week 18 of 2018, after the 2017/2018 Australian shipping season ended in May 2018.

Previous volumes are available from the Antarctic Climate & Ecosystems Cooperative Research Centre (see inside cover for details) and online here:
http://acecrc.org.au/services/sea-ice-charting/


SEA ICE REPORTING 2018/19 VOYAGES
Legend
Australian Antarctic Bases
RSV Aurora Australis Voyage 1
RSV Aurora Australis Voyage 2
RSV Aurora Australis Voyage 3
OPV l'Astrolabe Cp. Denison visit
RV Tangaroa Voyage 19/01
RV Investigator Voyage 2019-V01
AUSTRALIA
NEW ZEALAND
ANTARCTICA
Hobart
Wellington
Macquarie Island
Mawsons Huts
Casey
Davis
Mawson
Kerguelen Islands
Heard Island
80°E
100°E
120°E
140°E
160°E
160°W
60°E
40°E
0 200 400 600 800 1000 km
Projection: Azimuthal Equidistant
Central Meridian 120°E, Latitude of Origin 60°S
Horizontal Datum: WGS84
© Jan L Lieser (UTAS)
March 2019

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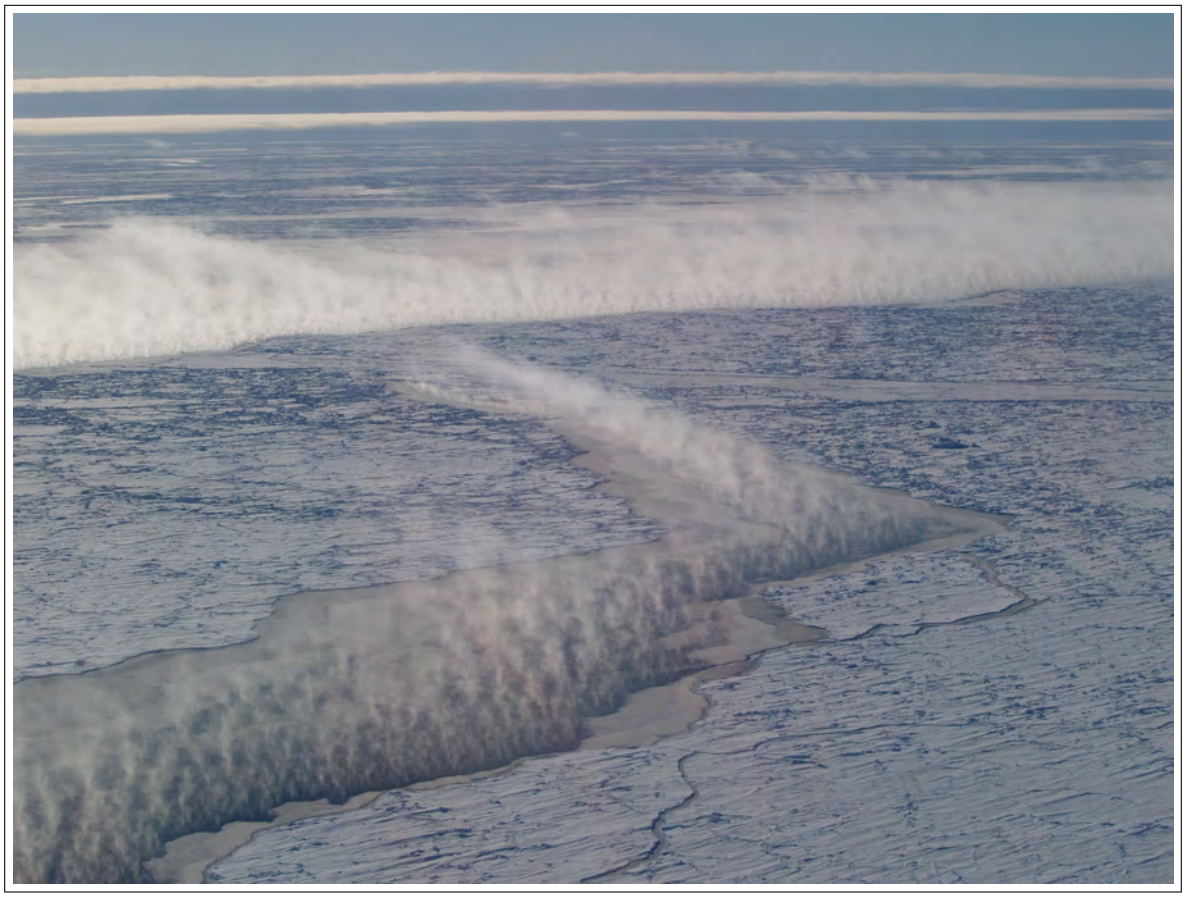
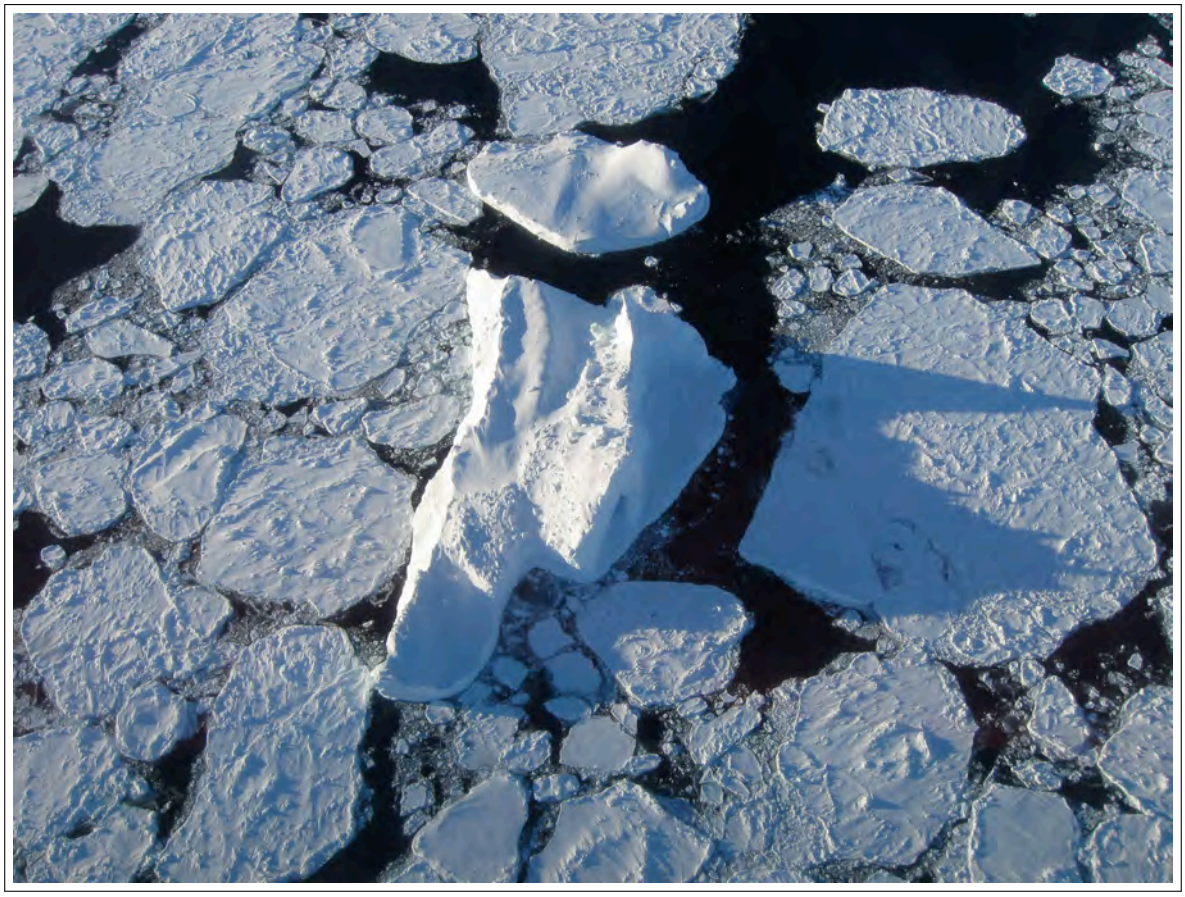


Frequently used acronyms

AMSR-2 [1]	Advanced Microwave Scanning Radiometer 2
DNB	Day-Night Band (panchromatic VIIRS channel)
ESA	European Space Agency
EW	Extra Wide swath (a SAR mode)
FASB	Call sign: Offshore Patrol Vessel *l'Astrolabe* (FRA)
GMRT	Global Multi-Resolution Topography
IBCSO	International Bathymetric Chart of the Southern Ocean
ICDC	Integrated Climate Data Centre, University of Hamburg (GER)
IW	Interferometric Wide swath (a SAR mode)
JAXA	Japan Aerospace Exploration Agency
MODIS [2]	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration (USA)
NSIDC	National Snow and Ice Data Center (USA)
OLI	Operational Land Imager (scientific payload on Landsat-8 satellite)
SAR	Synthetic Aperture RADAR
Suomi NPP	Suomi National Polar-orbiting Partnership
TIR	Thermal Infrared spectrum
USGS	United States Geological Survey (USA)
VIIRS	Visible Infrared Imaging Radionmeter Suite
VIS	Visible Spectrum
VNAA	Call sign: Research & Supply Vessel *Aurora Australis* (AUS)
ZMFR	Call sign: Research Vessel *Tangaroa* (NZ)



[1] The AMSR-2 instrument is onboard the GCOM-W1 satellite, which is operated by JAXA.
[2] The MODIS instrument is operational on two satellites: AQUA and TERRA, both operated by NASA.

Sea Ice Report #18.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
03/05/2018

Bellingshausen Sea

Figure 1 shows high-resolution (3.125 km horizontal resolution) sea-ice concentration data of the Bellingshausen Sea. The position of RVIB Nathaniel B Palmer on 04/05/2018 at 02:00 Z is given by the red dot.

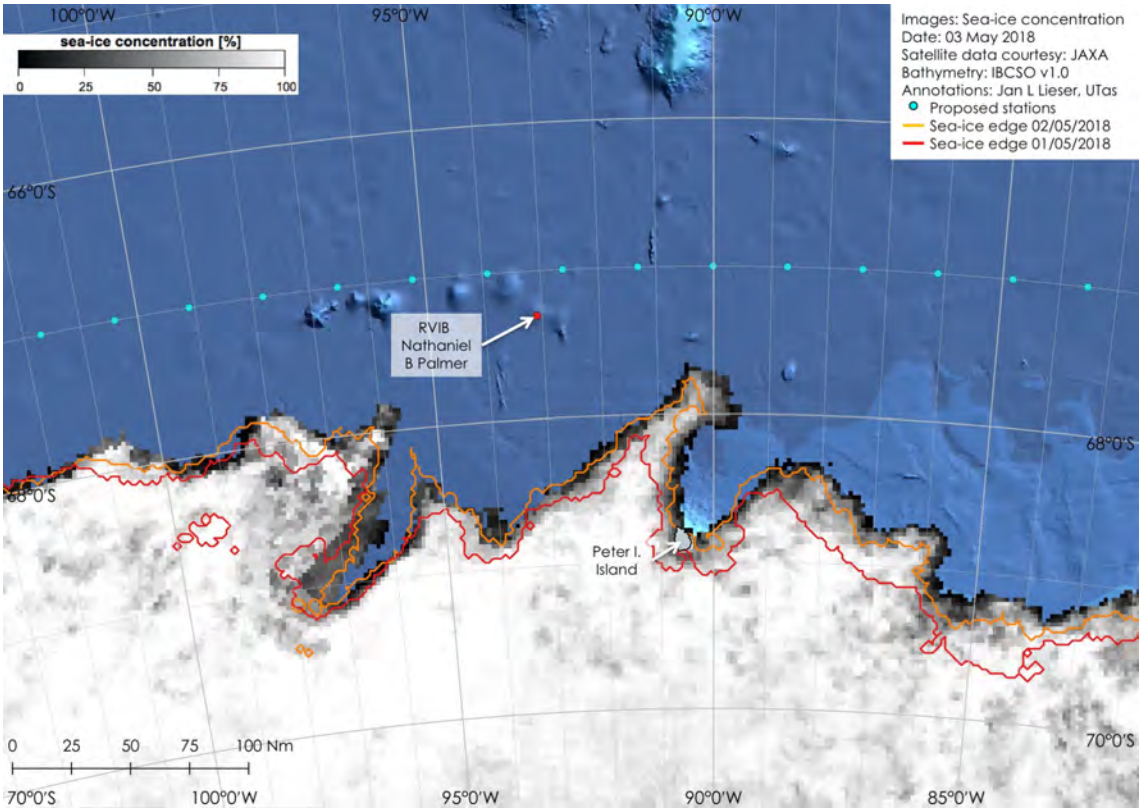


Figure 1: *Daily composite sea-ice concentration data acquired 03/05/2018 and provided by ICDC, Universität Hamburg.*

The expansion of sea ice in the region is evident from the shift in the position of the sea-ice edge (orange and red lines based on the same data product for previous days).

Figure 2 shows a SAR swath of the vicinity of the vessel. In addition to the annotations of the above figure, this figure shows the sea-ice edge for 03/05/2018 (Figure 1) and some larger icebergs are marked by red circles.

*Disclaimer: *Every effort is made to ensure the data provided in this report are accurate at the date of publication; however the report is provided without warranty of any kind. The figures and charts provided in this report are intended only as a guide to ice conditions and are not suitable for navigation.*

The SAR shows that new and young sea ice extends further north than the sea-ice edge suggests. Also, the difference between the location of the yellow line (15% sea-ice concentration boundary/sea-ice edge) and the extent of sea ice in the SAR data is attributed to the time difference in data acquisition of the two instruments on the same day (03/05/2018).

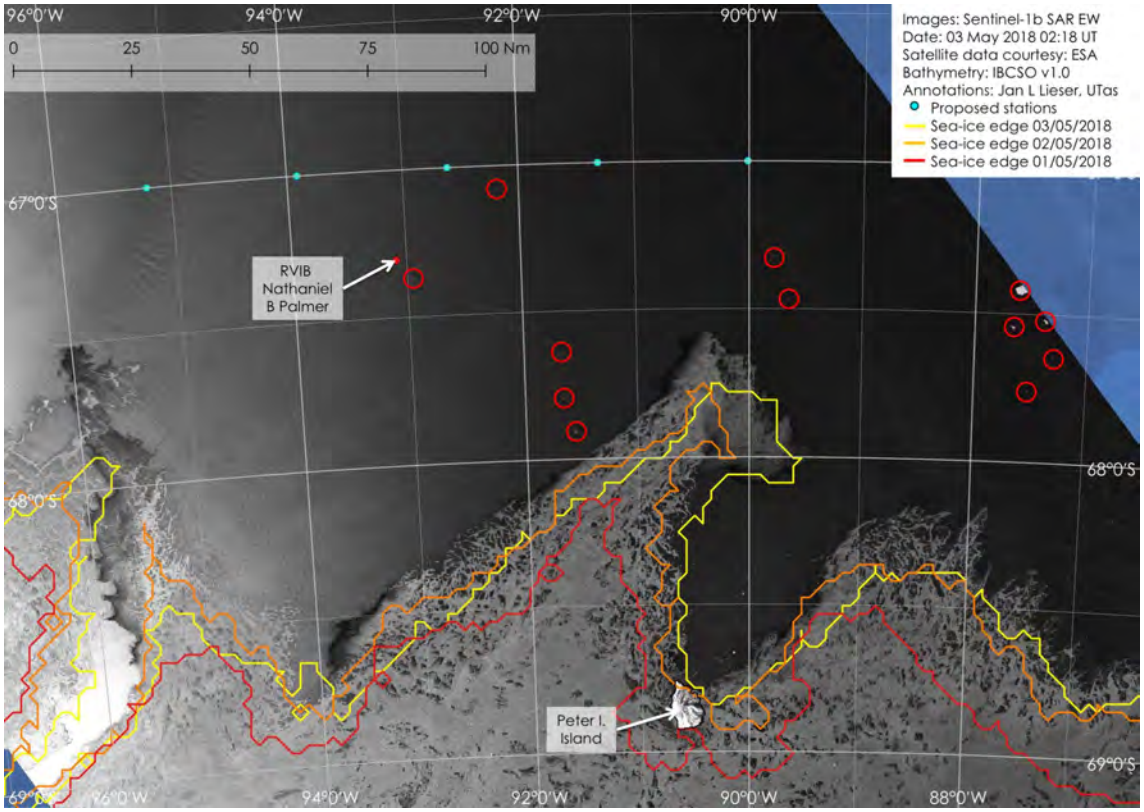


Figure 2: Sentinel-1a SAR EW scene acquired 03/05/2018 at 02:18 UT and provided by PolarView.

Sea Ice Report #19.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
07/05/2018

Bellingshausen Sea

Figure 1 shows high-resolution (3.125 km horizontal resolution) sea-ice concentration data of the Bellingshausen Sea. The position of RVIB Nathaniel B Palmer on 07/05/2018 at 02:00 Z is given by the red dot. The location of a large tabular iceberg is also marked. A swath of SAR data (Sentinel-1b SAR IW 05/05/2018 08:15 UT provided by PolarView) along the western Antarctic Peninsula shows very little sea ice over there in the east.

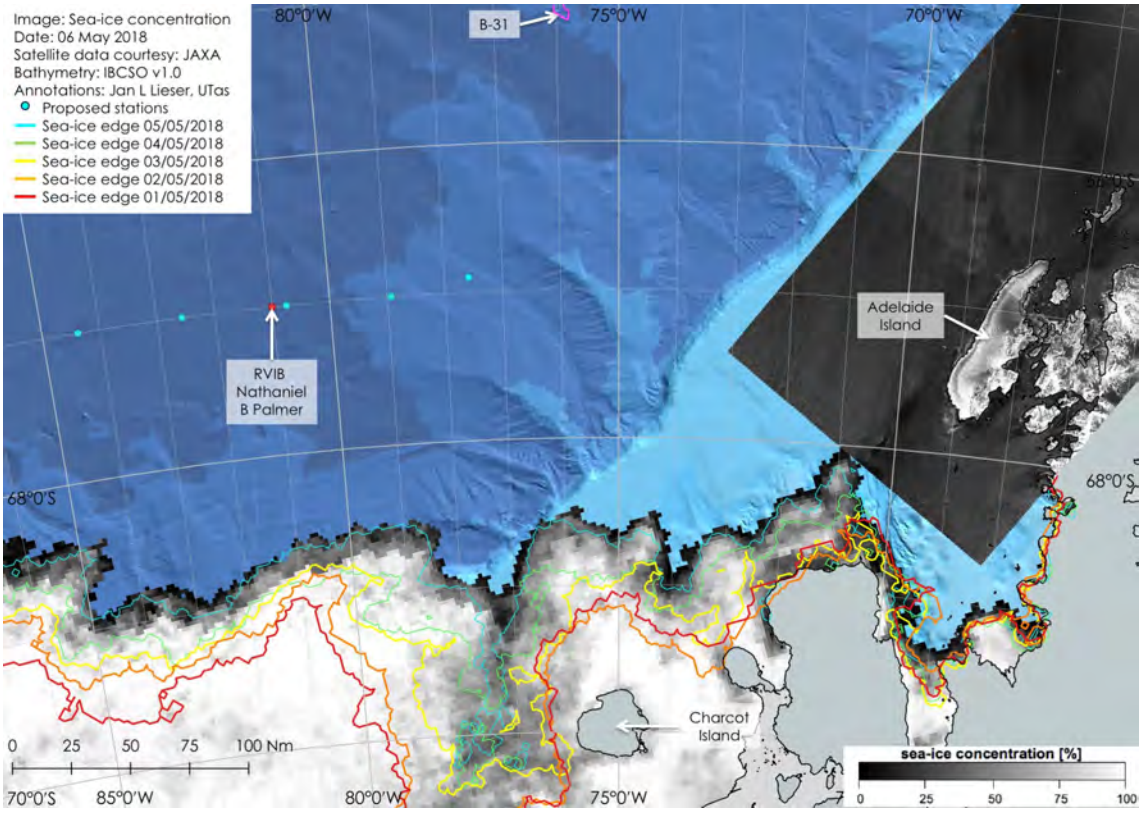


Figure 1: *Daily composite sea-ice concentration data acquired 06/05/2018 and provided by ICDC, Universität Hamburg.*

Sea ice is growing steadily and expanding northward in the region. The position of the sea-ice edge based on the same data product for previous days is given by coloured lines.

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Figure 2 shows a SAR scene of the vicinity of the vessel. Some larger icebergs are marked by red circles.

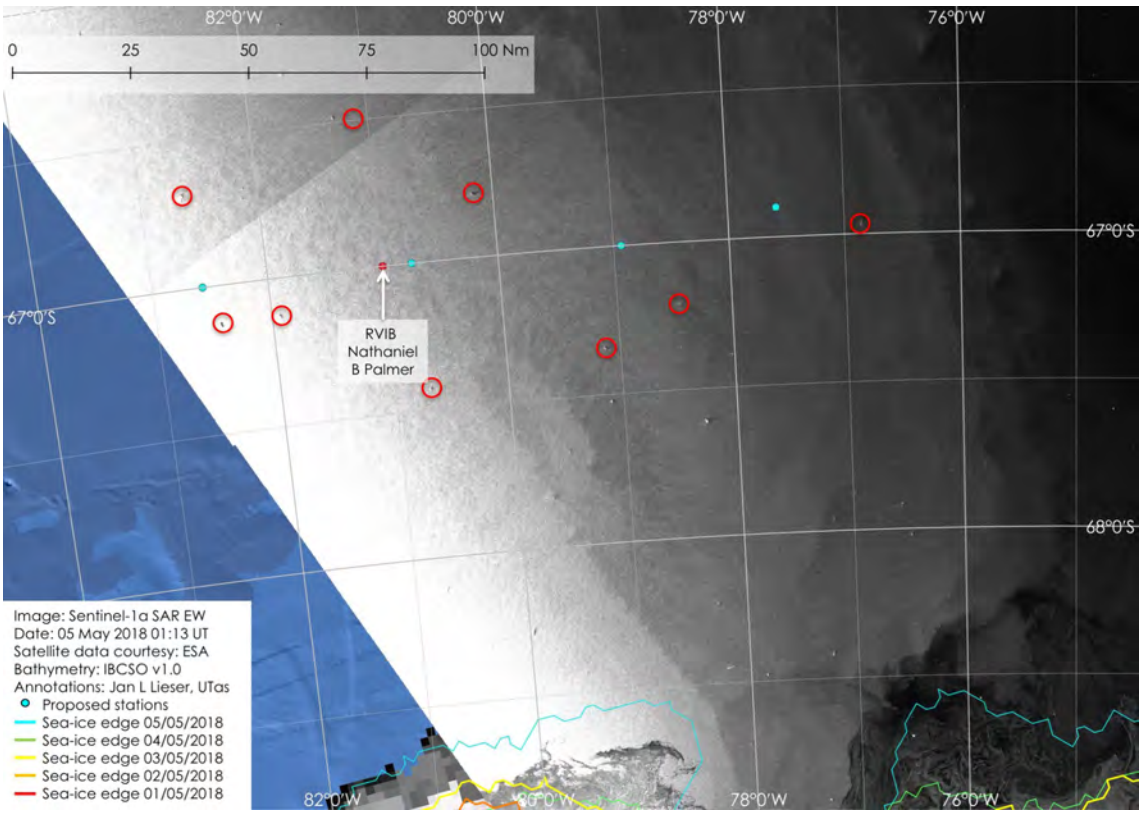

Figure 2: *Sentinel-1a SAR EW scene acquired 05/05/2018 at 01:13 UT and provided by PolarView.*

Sea Ice Report #19.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
10/05/2018

Bellingshausen Sea

Figure 1 shows a SAR scene of the northern Bellingshausen Sea. The position of RVIB Nathaniel B Palmer on 09/05/2018 at 22:00 Z is given by the red dot. Some larger icebergs are marked by red circles.

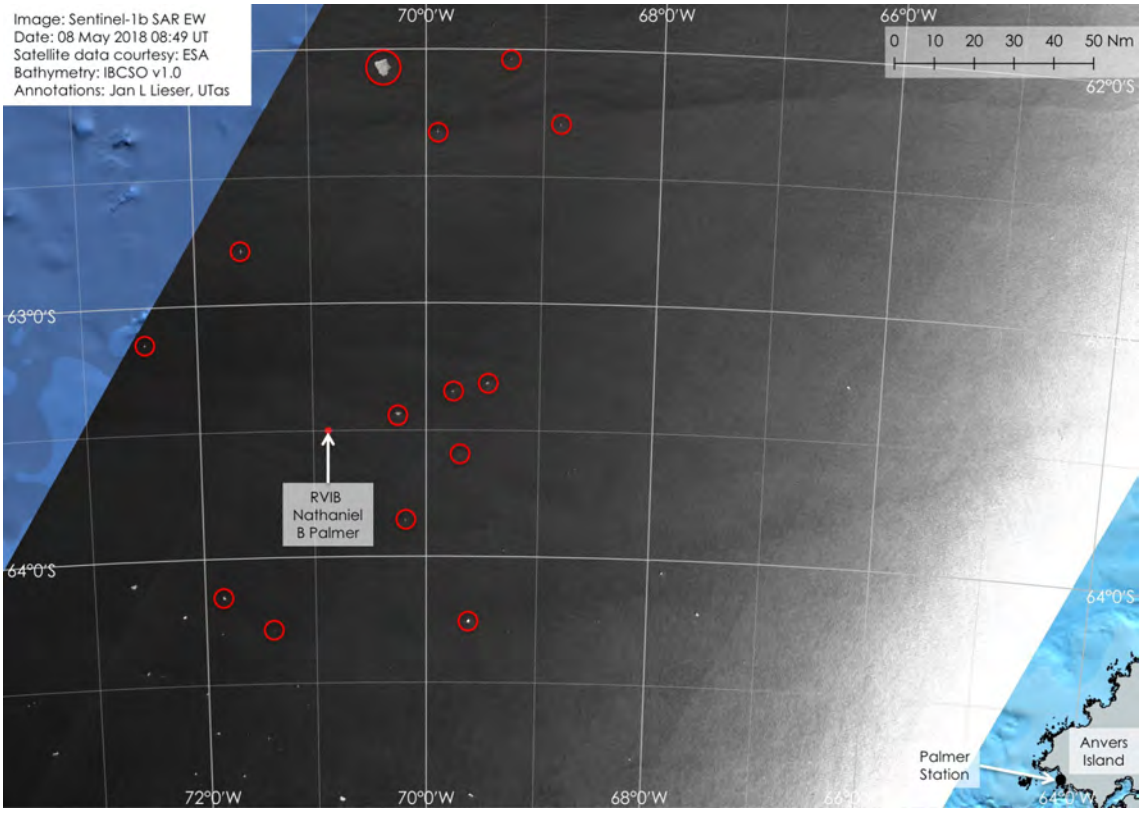

Figure 1: *Sentinel-1b SAR EW scene acquired 08/05/2018 at 08:49 UT and provided by PolarView.*

The vessel is currently operating in bergy waters. In a northern extension of the swath shown in Figure 1, icebergs and fragments of icebergs can be identified as far north as 61° 30' S with one larger iceberg (140 km^2) located at 69° 12' W on that latitude (on 08/05/2018 at 08:49 UT),

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Sea Ice Report #20.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/05/2018

In early May, the global sea-ice extent (Arctic Ocean and Antarctica combined) is on record low levels. While the Southern Hemisphere's extent is just above record low conditions of 1980 and 2017, the Arctic extent is almost on a par with 2016 record low extent, which combines to a new record globally.

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for April 2018.

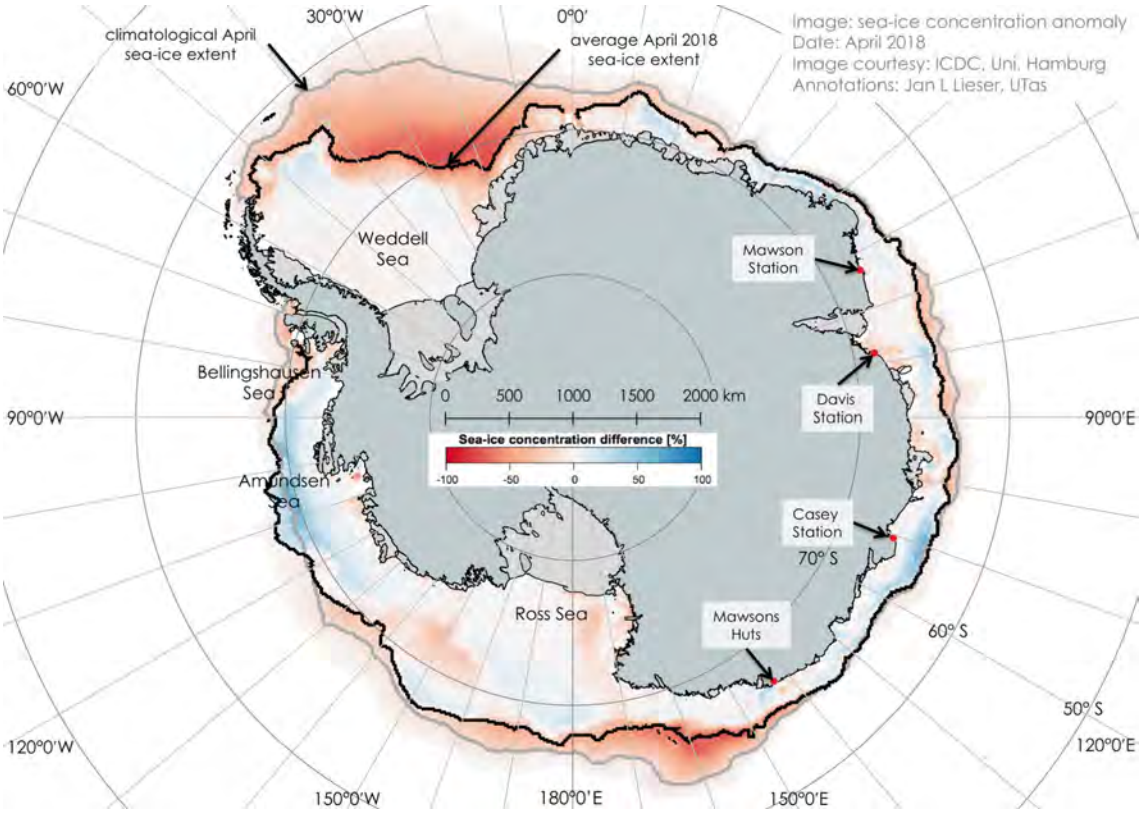

Figure 1: *Sea-ice concentration anomaly for April 2018 provided by ICDC, Universität Hamburg.*

In April 2018, generally below-average sea-ice concentration continued throughout most of Antarctica. This was most notable in the Weddell Sea

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and western Ross Sea. In the Amundsen Sea and parts of East Antarctica (between 30° E and 65° E and between 115° E and 140° E) sea-ice extent was close to average with slightly above-average sea-ice concentration within this extent.

Davis Station

Figure 2 shows a SAR scene of the Vestfold Hills and offshore.

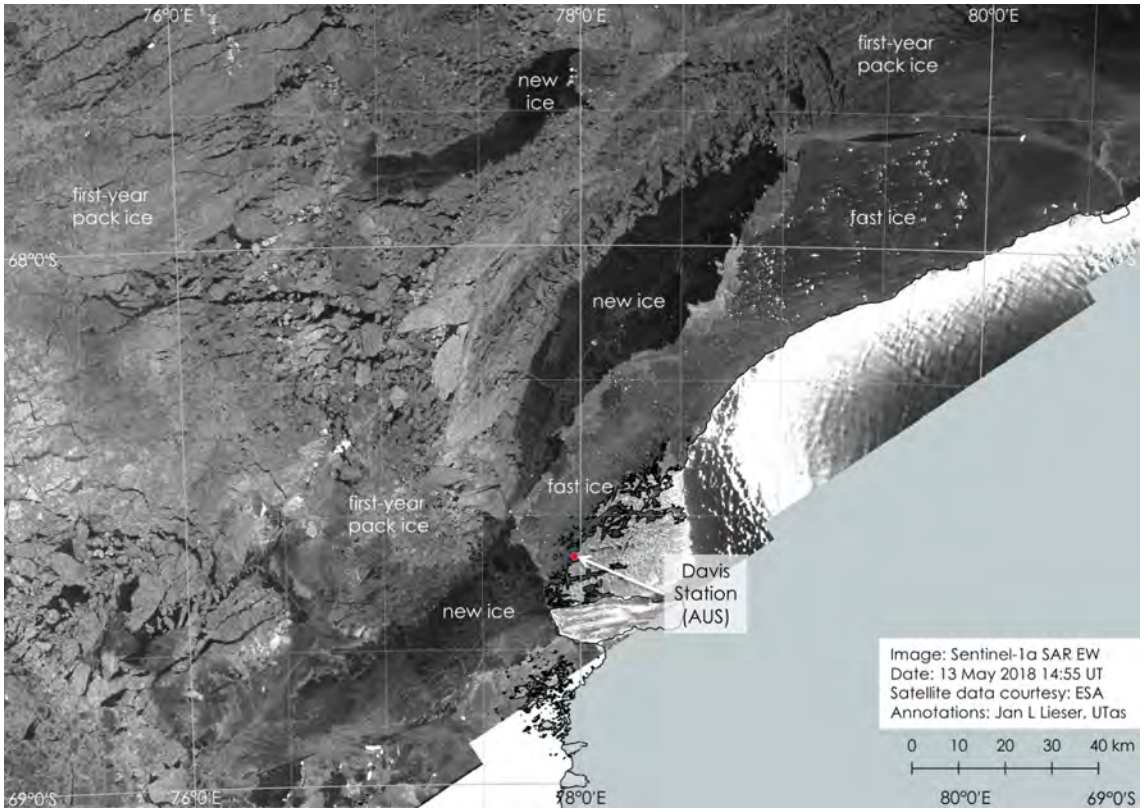

Figure 2: *Sentinel-1a SAR EW scene acquired 13/05/2018 at 14:55 UT and provided by PolarView.*

Offshore Davis Station and further north along the coastline, fast ice is growing shore-fast. Some isolated patches of fast ice are anchored between groups of icebergs (one of which can be seen at 78° E and 67° 40' S) resulting in open water downstream, where new ice is forming.

Sea Ice Report #20.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
17/05/2018

Commonwealth Bay

Figure 1 shows a SAR scene of Cape Denison and surrounds. Pink shapes indicate positions of various large icebergs on 21/03/2018 (see Sea Ice Report #12.5/2018). The location of an oceanographic mooring marks a yellow dot.

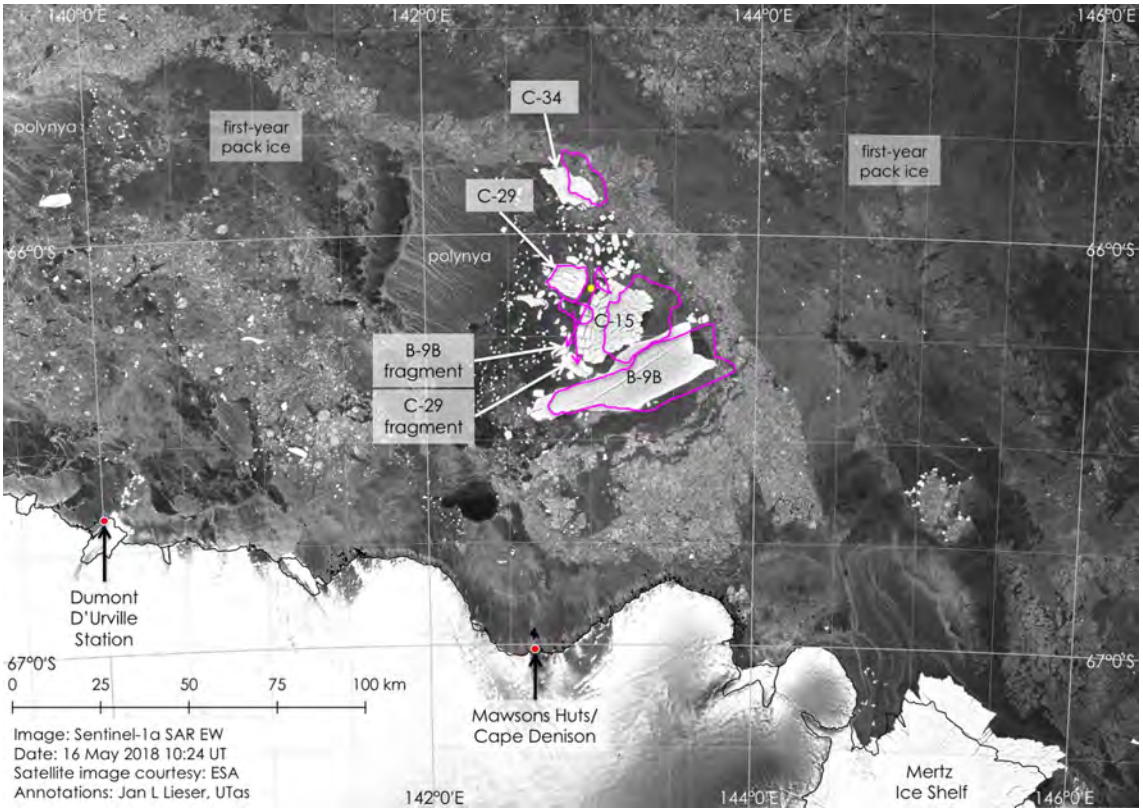

Figure 1: *Sentinel-1a SAR EW scene acquired 16/03/2018 at 10:24 UT and provided by PolarView.*

Between Dumont D'Urville Station and the Mertz Glacier, many different sea-ice types can be identified, which are predominantly of first-year origin. Since late March, four named icebergs have not moved much, but two marked fragments within the cluster of icebergs have. The B-9B fragment travelled roughly 21 km southwestward and the C-29 fragment about 16 km southward.

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Sea Ice Report #21.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
24/05/2018

Davis Station

Figure 1 shows a SAR scene of the Vestfold Hills and offshore.

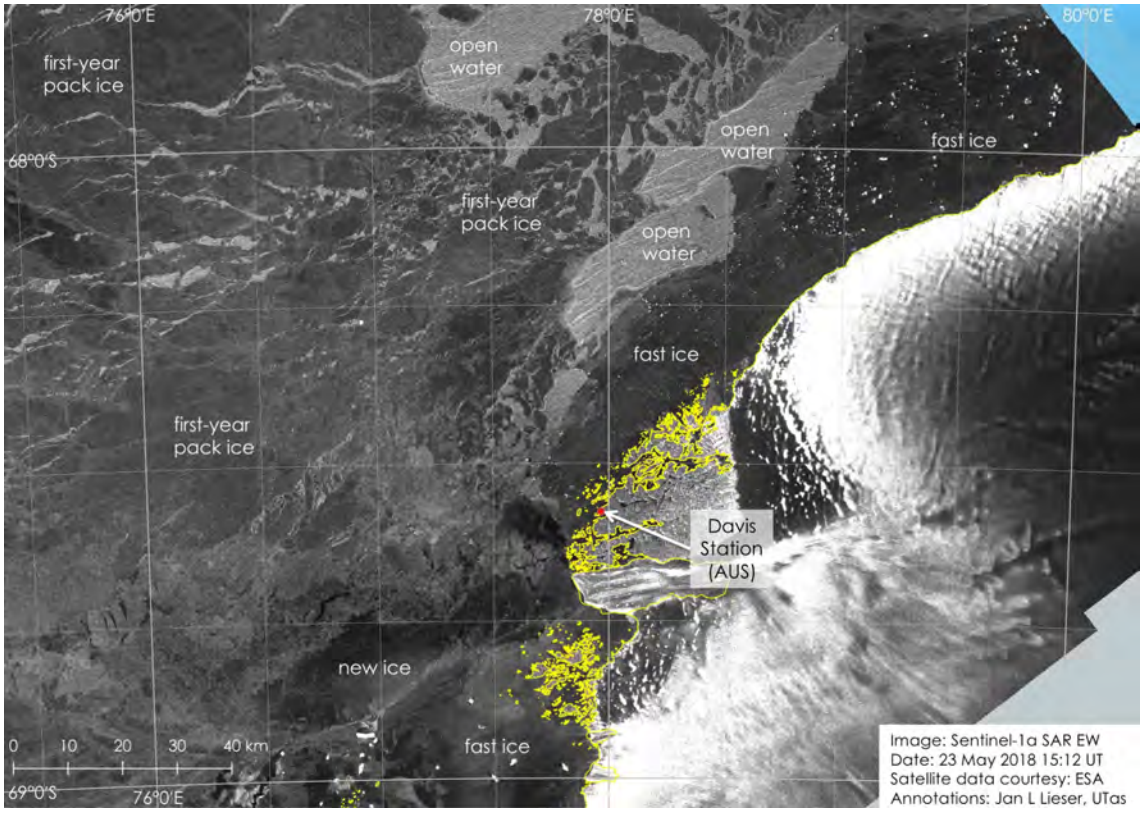

Figure 1: *Sentinel-1a SAR EW scene acquired 23/05/2018 at 15:12 UT and provided by PolarView.*

West of Davis Station, the fast-ice edge is approximately 10 km offshore. Off the fast-ice edge, sea ice appears mobile and drifting generally southwestward with patches of open water between first-year pack ice.

Further north, the rift between icebergs D-15A and D-15B (off the West Ice Shelf; not shown) has grown to almost 7 km width at its northern end.

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Casey Station

Figure 2 shows a SAR scene of the western flank of Law Dome and offshore.

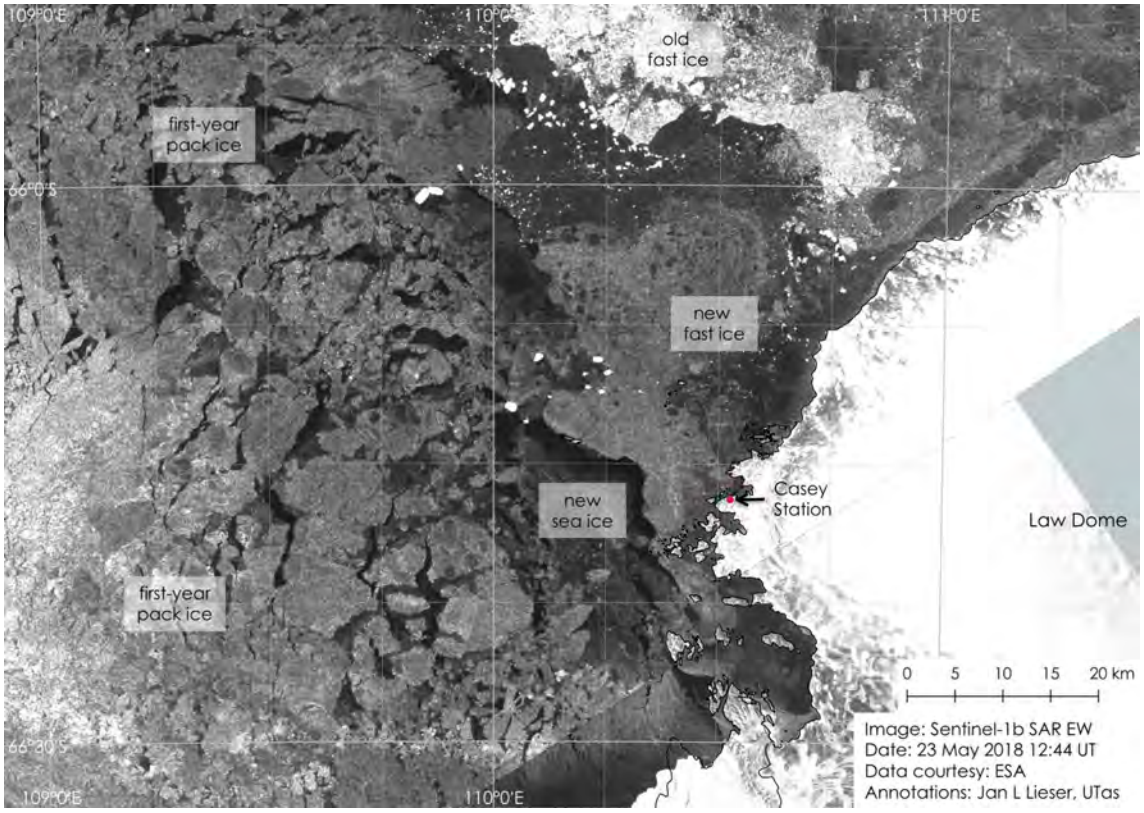

Figure 2: *Sentinel-1b SAR EW scene acquired 23/05/2018 at 12:44 UT complemented in the southeastern corner by a Sentinel-1a SAR IW scene acquired 22/05/2018 at 12:52 UT, both provided by PolarView.*

West of Casey Station, the fast-ice edge is approximately 9 km offshore. Off the fast-ice edge, sea ice appears mobile and drifting generally southward.

Sea Ice Report #22.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
28/05/2018

Iceberg D-15A

Figure 1 shows two SAR scenes of the D-15 icebergs north of the West Ice Shelf.

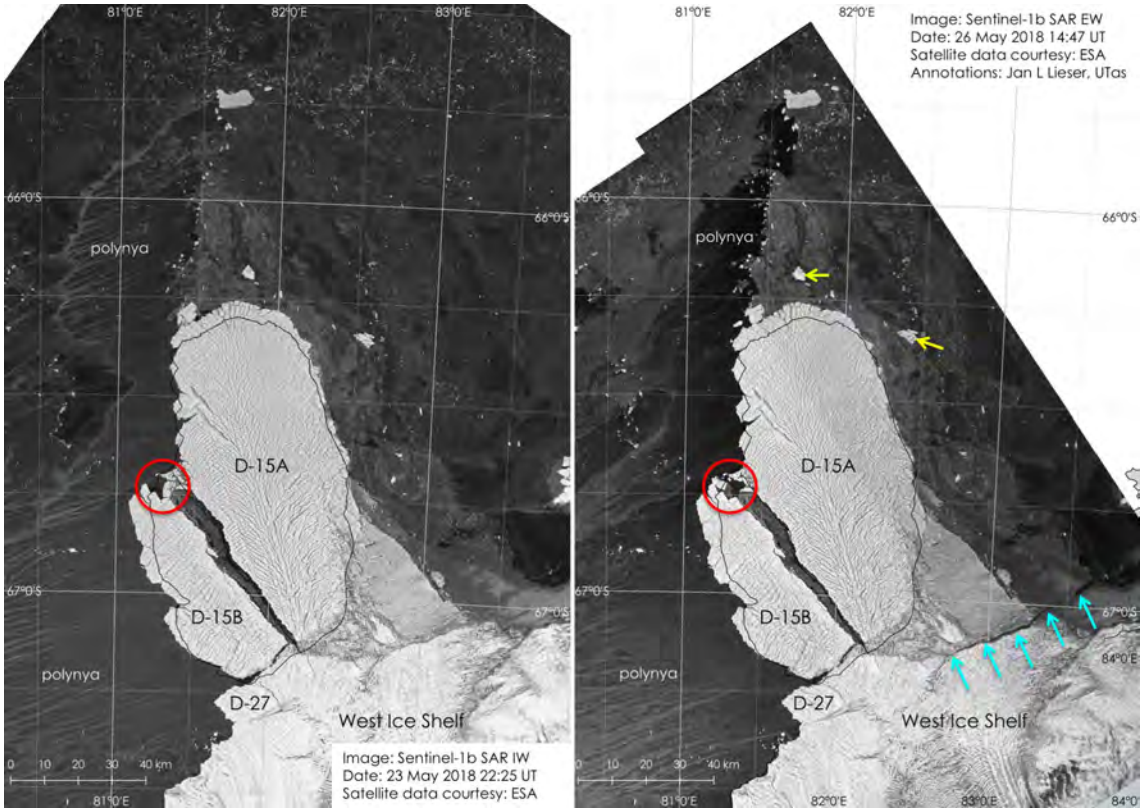

Figure 1: *Sentinel-1b SAR data provided by PolarView.*

Since 23/05/2018 (left panel of the figure), a small iceberg that was wedged between the D-15 icebergs (red circle) has moved westward and iceberg D-15A has rotated roughly 2 degrees anticlockwise (what is cause and what is effect is not clear at this stage). A large, proportional crack can be seen just off the West Ice Shelf front (marked by light blue arrows). As a result, the width of the crack between the D-15 icebergs is reduced by a little more than 1 km to approximately 5.7 km at its northern end. Yellow arrows show the movement of two larger iceberg fragments embedded in fast ice where the entire body of fast ice (of various age) north and east of iceberg D-15 has shifted with the berg.

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Sea Ice Report #24.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
13/06/2018

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for May 2018.

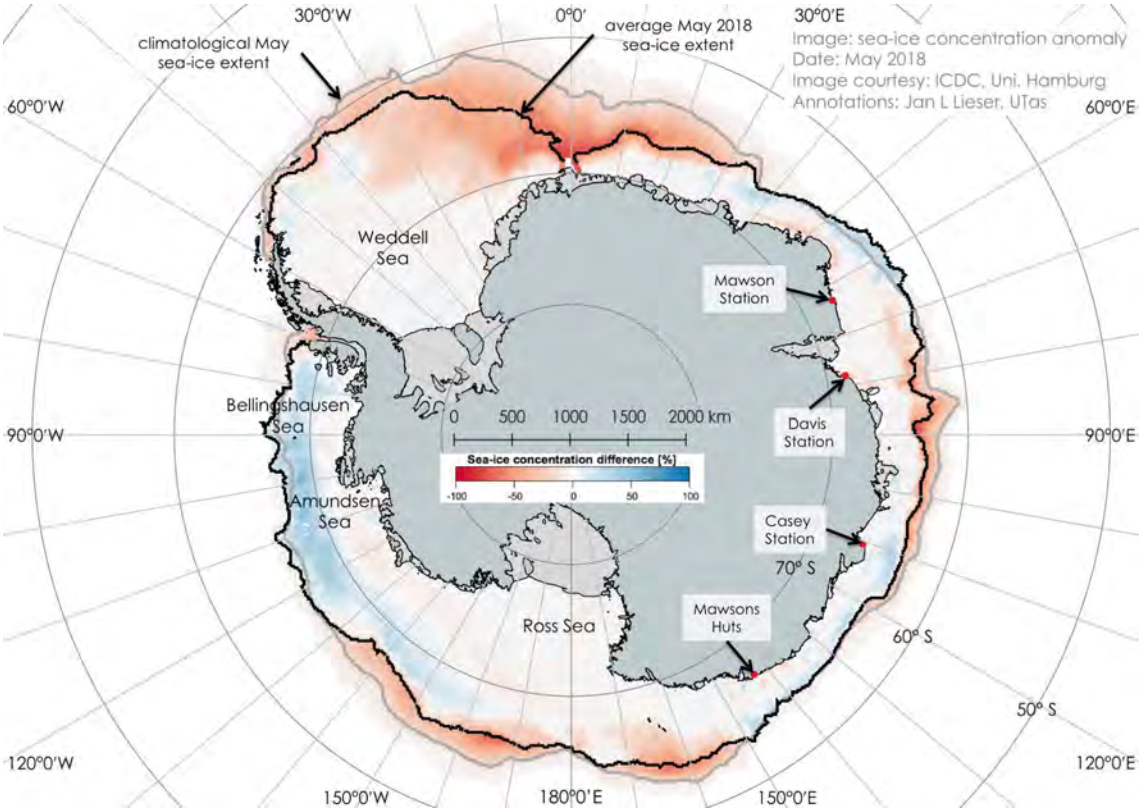

Figure 1: *Sea-ice concentration anomaly for May 2018 provided by ICDC, Universität Hamburg.*

In May 2018, generally below-average sea-ice concentration continued throughout most of Antarctica. This was still most notable in the eastern Weddell Sea, but also in the Ross Sea and parts of East Antarctica (between 70° E and 120° E).

In the Bellingshausen Sea and Amundsen Sea, sea-ice extent was close to average with slightly above-average sea-ice concentration within this extent.

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Sea Ice Report #27.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
05/07/2018

Davis Station

Figure 1 shows a high-resolution SAR scene of Davis Station and the Vestfold Hills and offshore.

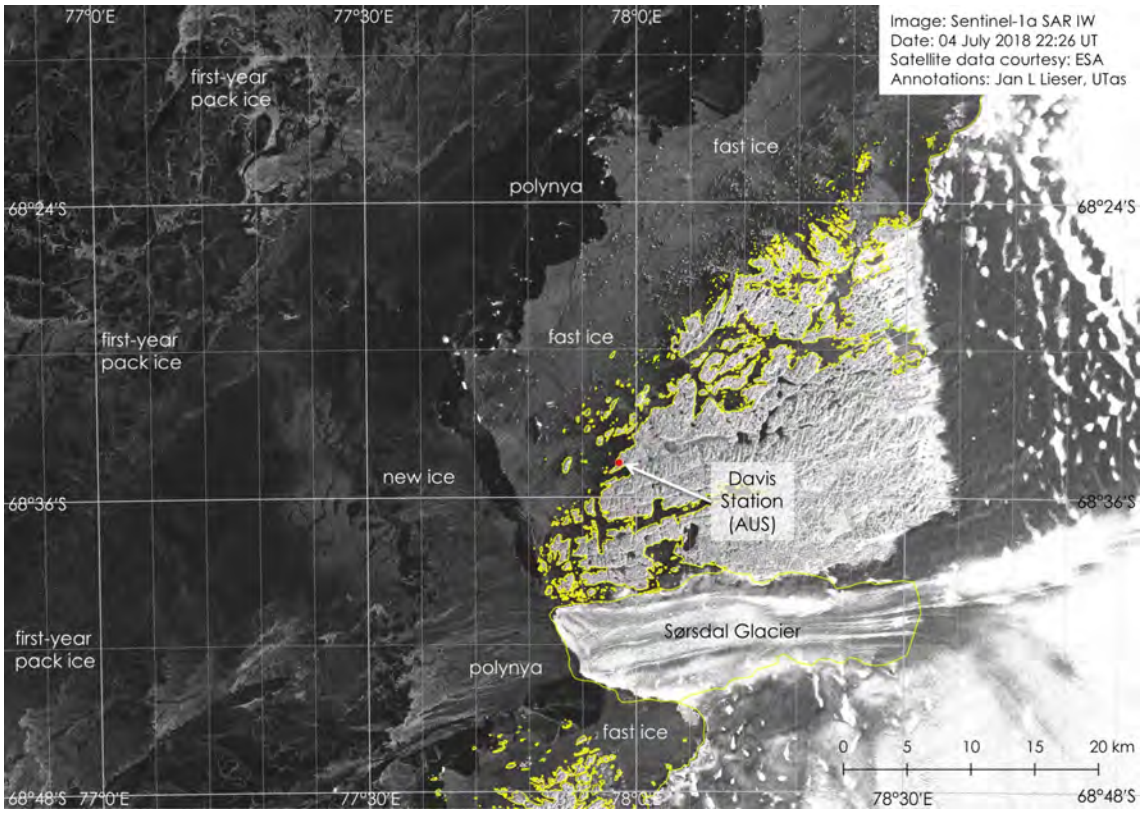

Figure 1: *Sentinel-1a SAR IW scene acquired 04/07/2018 at 22:26 UT and provided by PolarView.*

North of the hills, fast ice has grown offshore where grounded icebergs provide anchor points for its stabilisation. New sea ice is forming off the fast-ice edge and in the polynya off Sørsdal Glacier. Further offshore, first-year pack ice is drifting southwestward towards Prydz Bay.

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Ninnis Ice Shelf

Figure 2 shows a high-resolution SAR scene of the Ninnis Ice Shelf and surrounds.

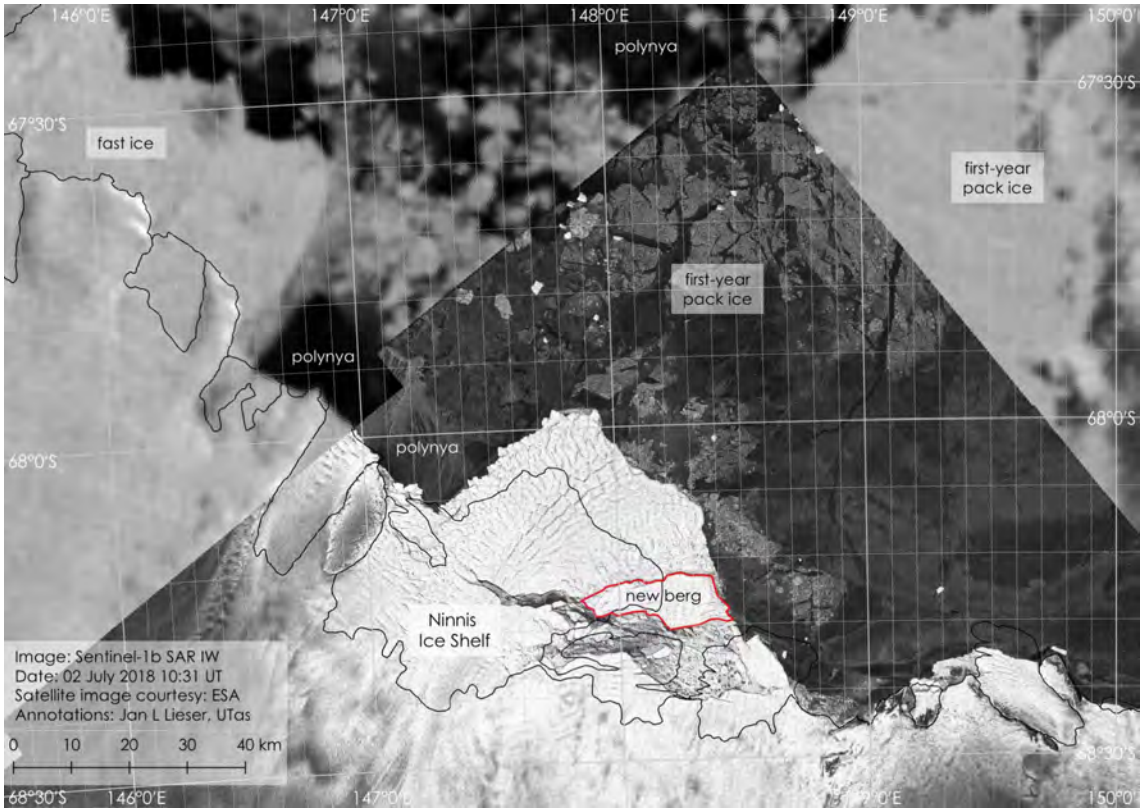

Figure 2: *Sentinel-1b SAR IW scene acquired 02/07/2018 at 10:31 UT and provided by PolarView; complemented by Suomi-NPP VIIRS-DNB data acquired 03/07/2018 and provided by NASA.*

Off the Ninnis Ice Shelf, broken first year sea ice is drifting northward currently. The front of the shelf has been moving northward as well, since late May at roughly 100 m per week, which is widening the large rift that can clearly be seen approximately 20 km north of the grounding line. Meanwhile, a large proportion of the eastern shelf has separated from the northward moving part of the shelf and created a new iceberg (red shape; roughly 150 km^2) .

Sea Ice Report #28.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/07/2018

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for June 2018.

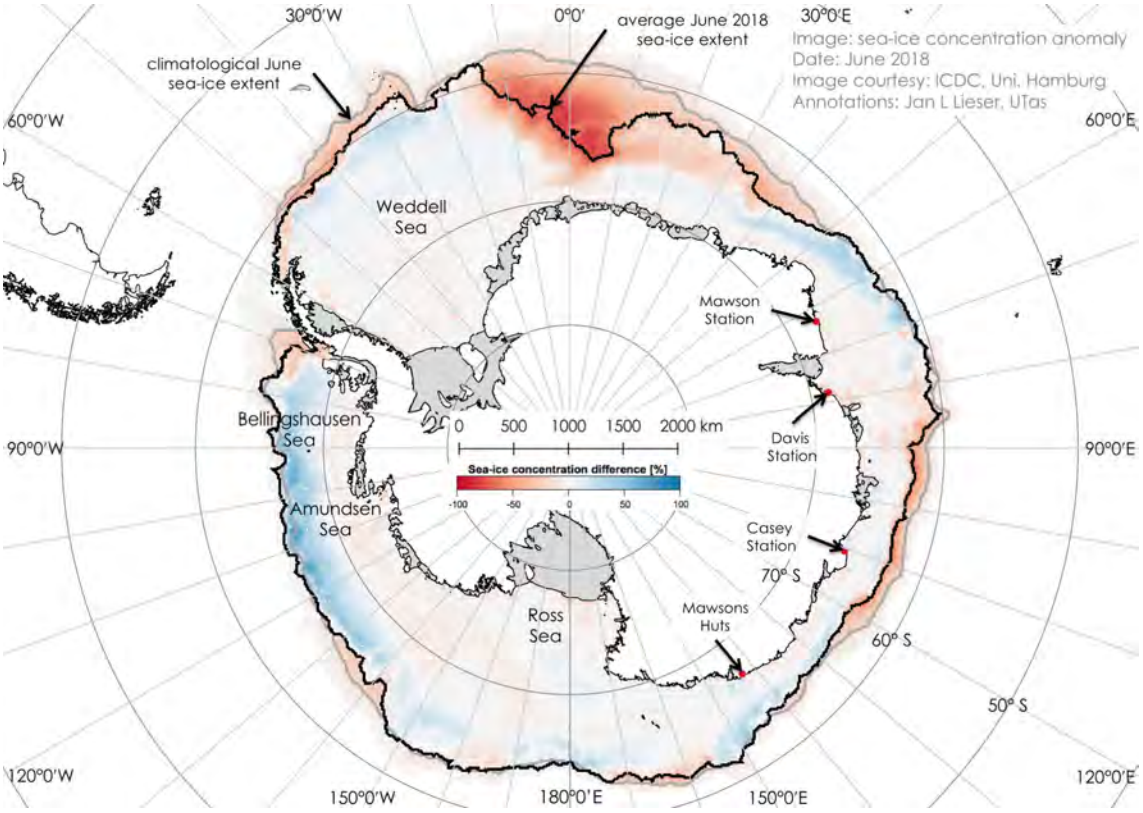

Figure 1: *Sea-ice concentration anomaly for June 2018 provided by ICDC, Universität Hamburg.*

In June 2018, sea-ice extent and concentration are edging closer to average conditions throughout most of Antarctica. Still a notable exception to this is the eastern Weddell Sea and to a lesser degree the western Weddell Sea and parts of East Antarctica (between 80° E and 130° E). In East Antarctica, the negative anomaly has moved roughly 10 degrees eastward.
In the Bellingshausen Sea and Amundsen Sea, sea-ice extent was close to average with above-average sea-ice concentration within this extent, except for the western Antarctic Peninsula region.

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Sea Ice Report #29.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
17/07/2018

Sabrina Coast

Figure 1 shows a high-resolution SAR scene of Sabrina Coast and offshore.

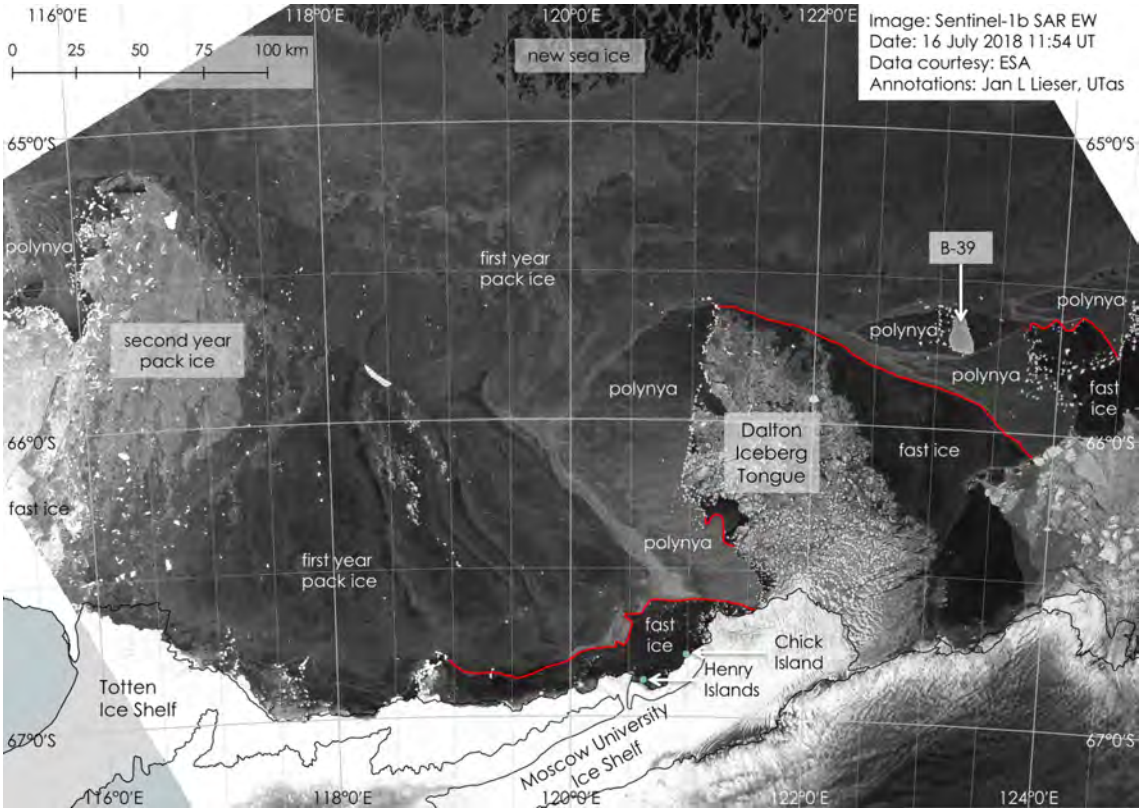

Figure 1: *Sentinel-1b SAR EW scene acquired 16/07/2018 at 11:54 UT and provided by PolarView.*

West of the Dalton Iceberg Tongue, the polynya is active and newly formed sea ice is pushed westward, which is evident from the banding in the SAR signature west of the sea-ice edge. Further west, brighter SAR signatures (lighter grey) indicate second year sea ice, which survived the previous summer and is now being pushed against (and thereby deformed and squeezed northward) the fast-ice barrier northwest of Totten Ice Shelf.

Off Henry Islands and Chick Island, fast ice has grown seaward.

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Commonwealth Bay

Figure 2 shows a high-resolution SAR scene of Commonwealth Bay/Cape Denison and surrounds.

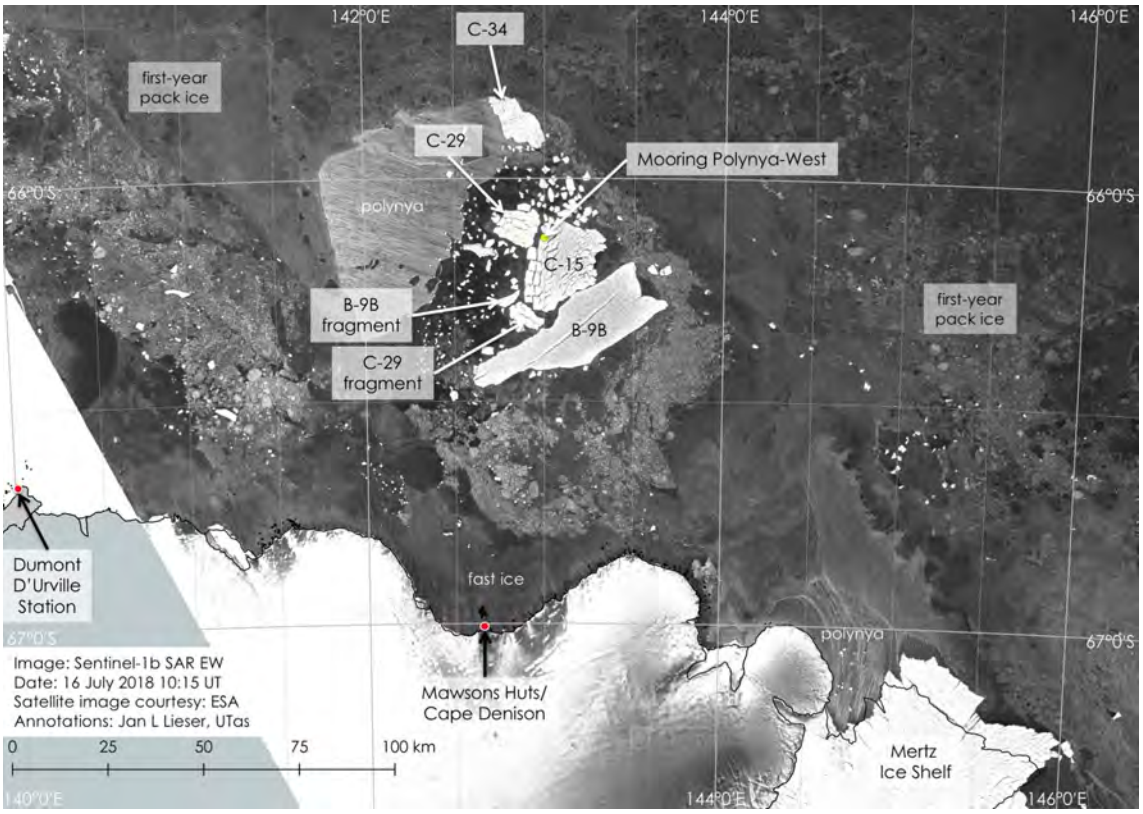

Figure 2: *Sentinel-1b SAR EW scene acquired 16/07/2018 at 10:15 UT and provided by PolarView.*

North of Commonwealth Bay (Mawsons Huts/Cape Denison), four large tabular icebergs and their fragments are surrounded by many smaller, grounded icebergs. Icebergs B-9B and C-15 remain unsettled and iceberg C-15 is currently occupying the location of an oceanographic mooring (yellow dot). Iceberg C-34 swivels around its southeastern end and iceberg C-29 is trapped between smaller icebergs and iceberg C-15. While those smaller bergs provide anchor points for fast ice to form, east and south of the aggregation of icebergs pack ice remains mobile. West of the fast ice, a polynya has developed.

Offshore Cape Denison, fast ice has formed in Commonwealth Bay but the boundary between this fast ice and pack ice north of it (towards iceberg B-9B) is blurred.

Sea Ice Report #30.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
26/07/2018

Mawson Coast

Figure 1 shows a high-resolution SAR scene of Mawson Coast and offshore.

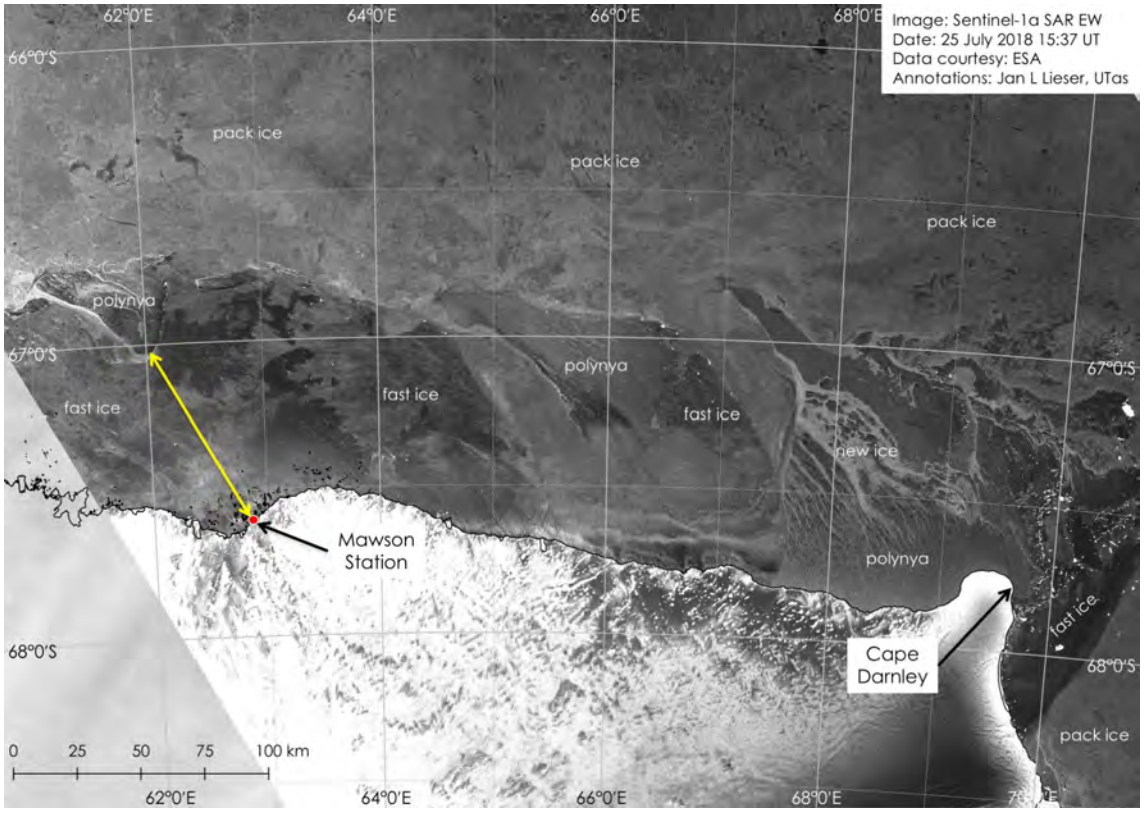

Figure 1: *Sentinel-1a SAR EW scene acquired 25/07/2018 at 15:37 UT and provided by PolarView.*

Off Mawson Station and further east, a typical distribution of land-fast sea ice and polynyas is found (including near Cape Darnley). Pack ice is further offshore.

The shortest distance between the station and open water (a polynya in the northwest) is currently 41 nautical miles (yellow arrow).

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Budd Coast

Figure 2 shows a scene acquired by the 'Day-Night-Band' of the VIIRS instrument (on-board the Suomi NPP satellite). While the band is affected by the presence of clouds, it provides a good indication of open ocean versus ice-covered surface of the Earth.

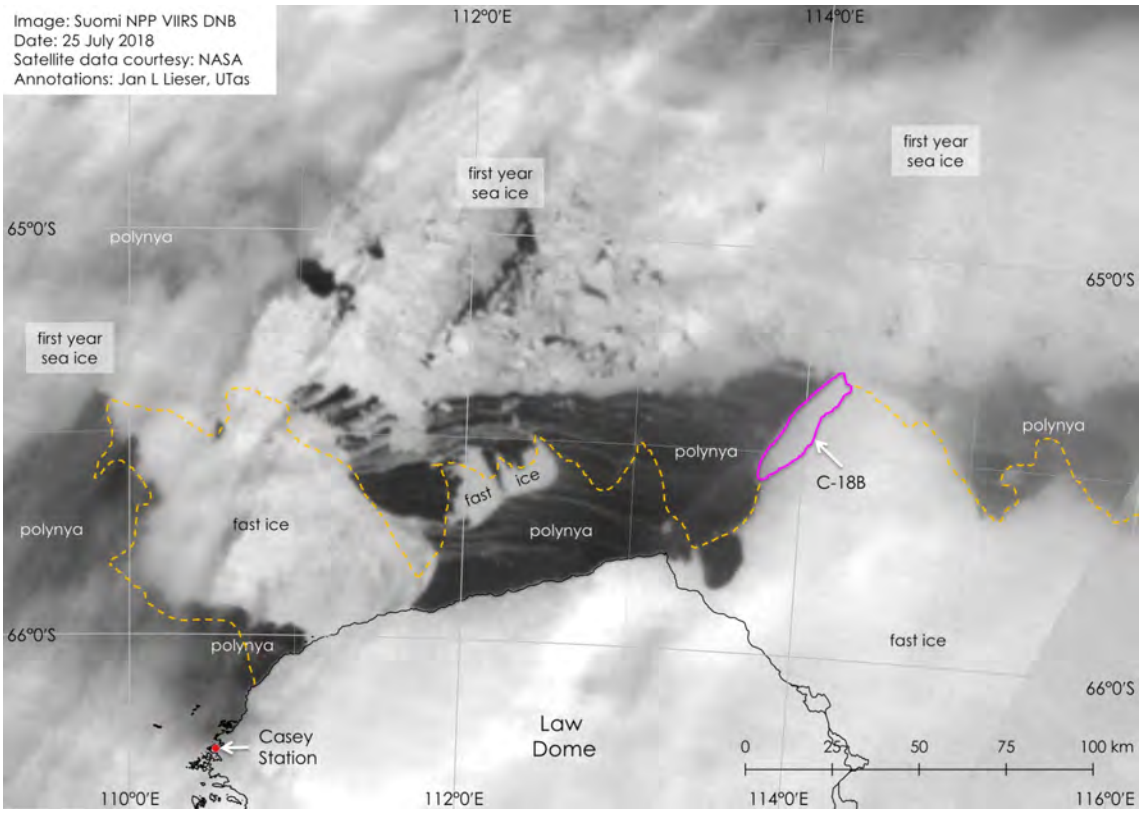

Figure 2: *Suomi NPP VIIRS DNB scene acquired 25/07/2018 and provided by NASA.*

Recent weather has changed the distribution of fast ice north of Casey Station and further along the Low Dome coast. The fast-ice edge from the beginning of July (01/07/2018) is indicated by the dashed, orange line. The fast ice that has broken out is now forming part of the mixture of first-year sea ice in the north and is drifting westward with the pack.

Sea Ice Report #32.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
06/08/2018

Davis Station

Figure 1 shows a high-resolution SAR scene of Davis Station and offshore.

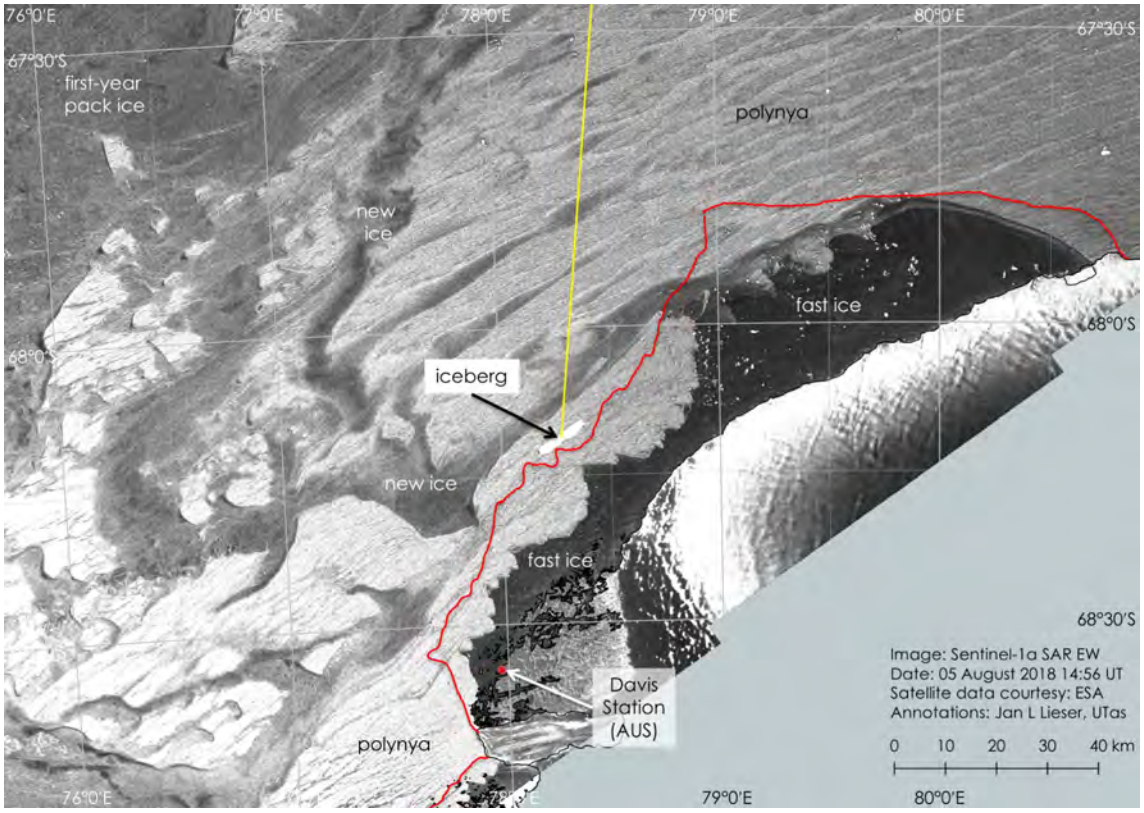

Figure 1: *Sentinel-1a SAR EW scene acquired 05/08/2018 at 14:56 UT and provided by PolarView.*

Recent weather events have reduced the fast ice off the Vestfold Hills and north of it. On 24/07/2018, the fast-ice edge was further offshore as indicated by the red scribble line. More than 1400 km^2 have broken away. West of the station, the fast-ice edge has moved roughly 3.3 km closer to the shore.

During the same time, a large iceberg (approximately 18 km^2) has travelled more than 180 km southward (yellow line) and is currently north of the hills.

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Sea Ice Report #32.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
10/08/2018

Davis Station

Figure 1 shows a high-resolution SAR scene of Davis Station and the Vestfold Hills and offshore.

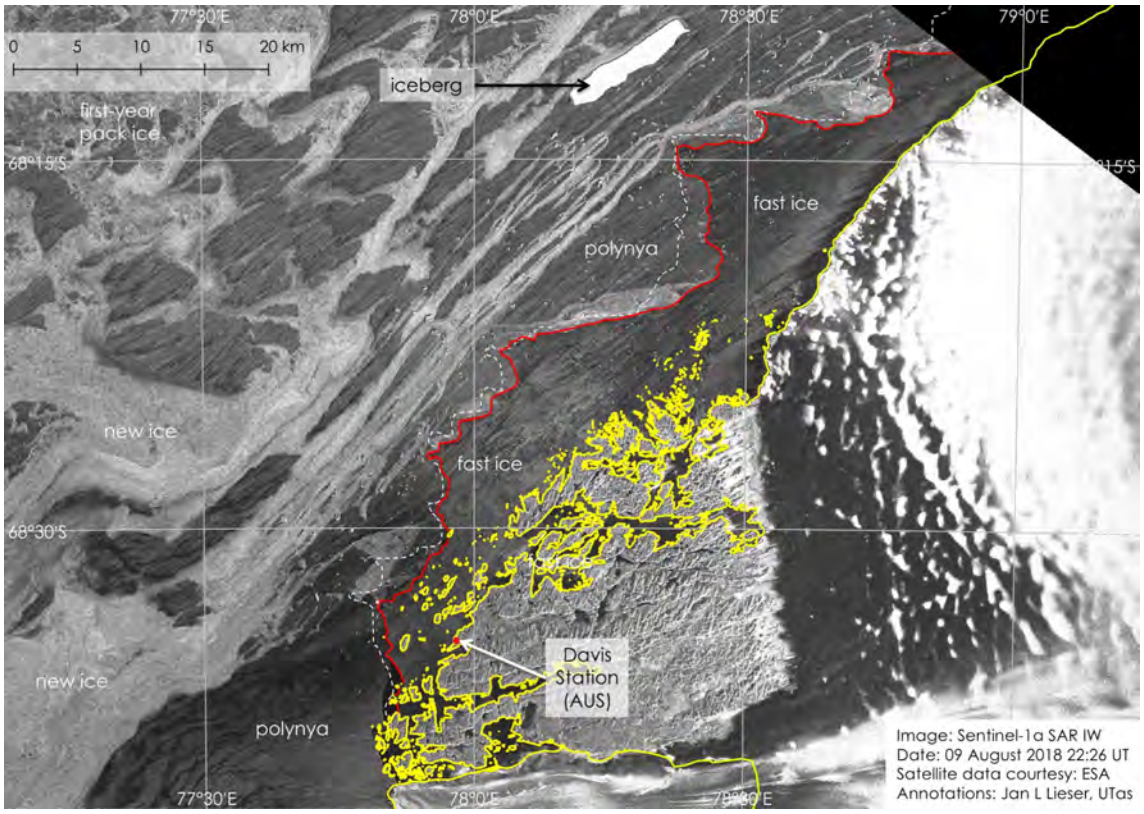

Figure 1: *Sentinel-1a SAR IW scene acquired 09/08/2018 at 22:26 UT and provided by PolarView.*

North of the hills, fast ice continues to break up (see Sea Ice Report #32.1/2018). The fast-ice edge from 05/08/2018 has been included in Figure 1 as a dashed, white line. The current fast-ice edge is marked by a red scribble line and is less than 3 nautical miles west of the station.

Off the fast ice north of the station, a large iceberg has not moved since 05/08/2018 and may be temporarily grounded in about 150 m water depth.

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Ninnis Ice Shelf

Figure 2 shows a high-resolution SAR scene of the Ninnis Ice Shelf.

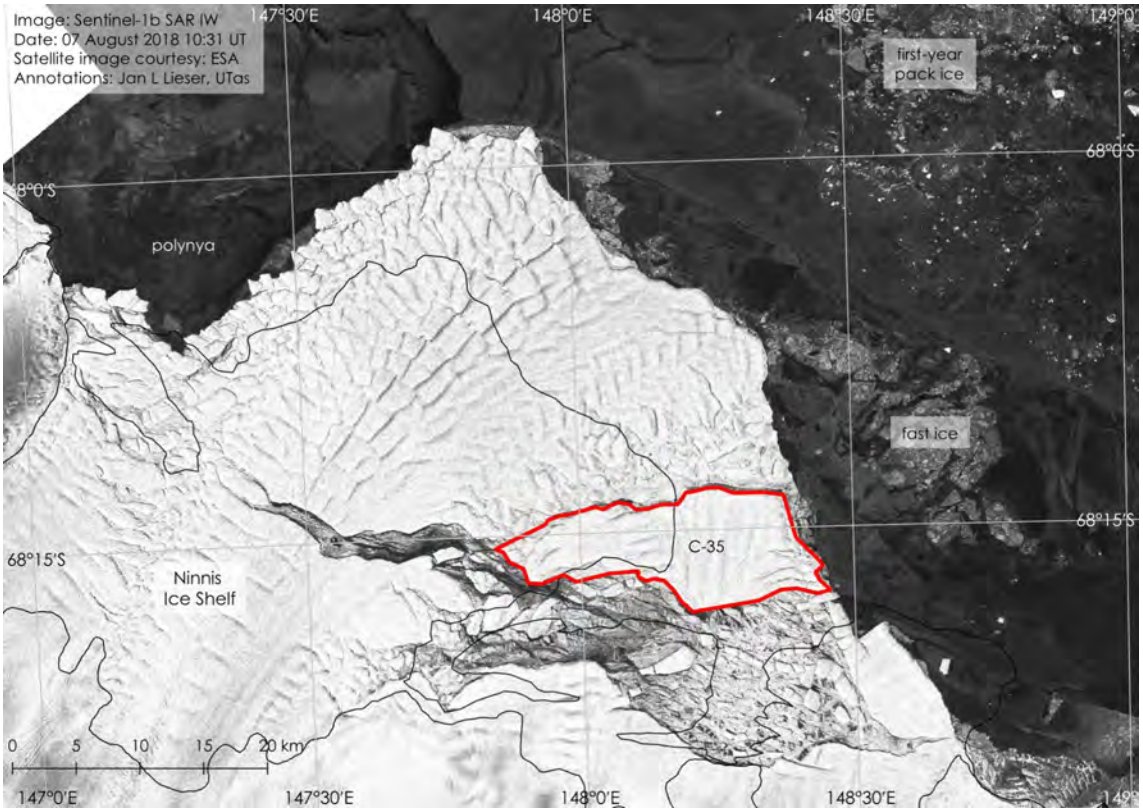

Figure 2: *Sentinel-1b SAR IW scene acquired 09/08/2018 at 10:31 UT and provided by PolarView.*

The new iceberg (red shape in Figure 2), which was spotted about a month ago (see Sea Ice Report #27.1/2018), has now been identified as C-35 and included in the official iceberg-tracking data base.

Sea Ice Report #33.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
13/08/2018

D'Urville Sea

Figure 1 shows a high-resolution SAR scene of the southern D'Urville Sea. The positions of two icebergs on 08/08/2018 are marked by dashed, pink shapes. The fast-ice edge is indicated by a red scribble line.

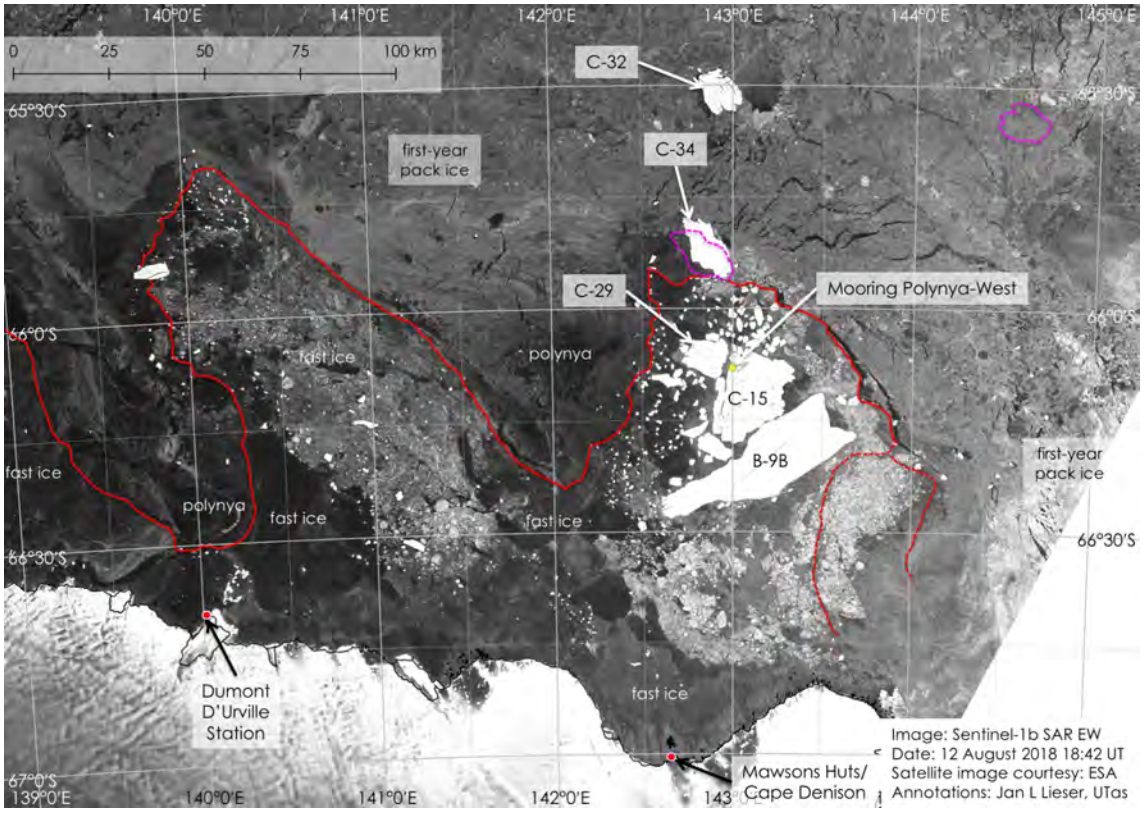

Figure 1: *Sentinel-1b SAR EW scene acquired 12/08/2018 at 18:42 UT and provided by PolarView.*

Since 08/08/2018, iceberg C-32 has drifted approximately 43 nautical miles and rotated at least 140 degrees, while iceberg C-34 has turned roughly 15 degrees anti-clockwise and appears to be grounded only at its southeastern end. All other large icebergs north of Cape Denison/ Commonwealth Bay are enclosed by highly heterogeneous fast ice.
A large iceberg grounded north of Dumont D'Urville Station shows a new east-west oriented rift.

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Sea Ice Report #34.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
20/08/2018

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for July 2018.

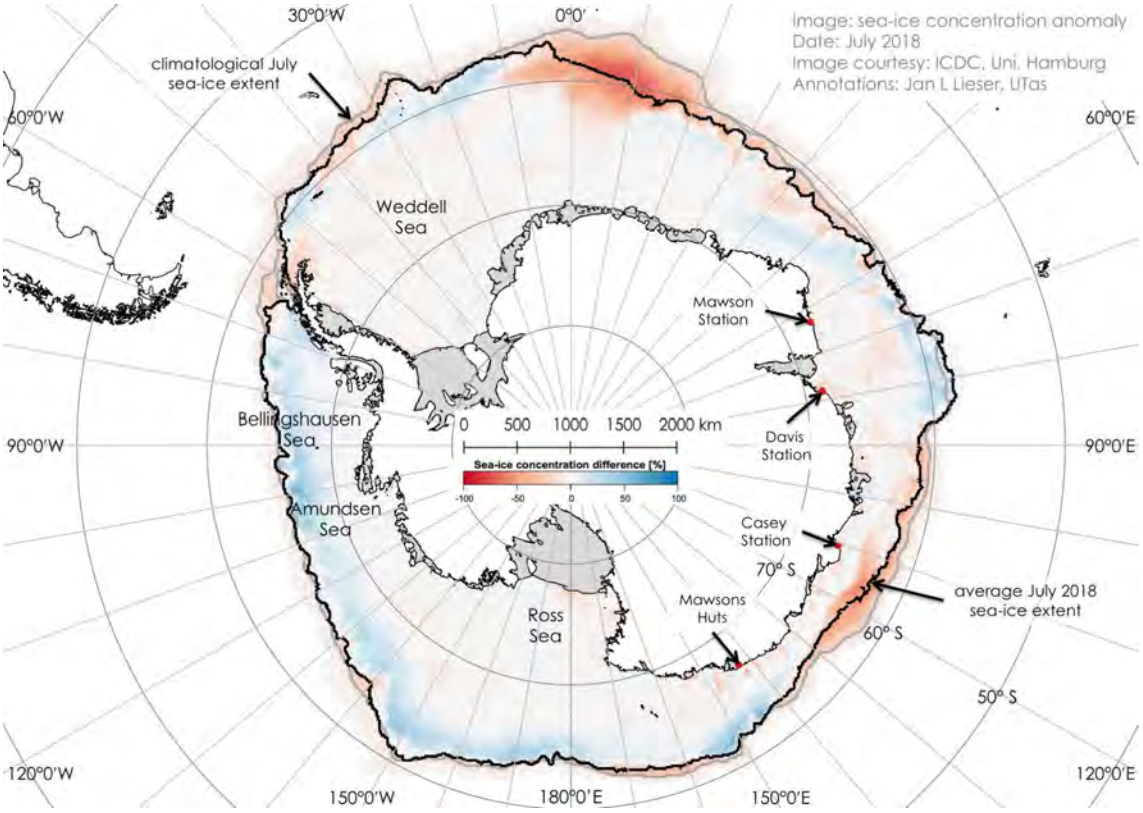

Figure 1: *Sea-ice concentration anomaly for July 2018 provided by ICDC, Universität Hamburg.*

In July 2018, sea-ice extent and concentration are again lower than average conditions throughout most of Antarctica. The eastern Weddell Sea remains the stand-out feature in that respect and parts of East Antarctica (between 90° E and 140° E). In East Antarctica, the negative anomaly has moved roughly 10 degrees eastward again in July (see Sea Ice Report #28.1/2018).
In the Bellingshausen Sea, Amundsen Sea and most of Ross Sea, sea-ice extent was close to average with above average sea-ice concentration within this extent, except for the northwestern Antarctic Peninsula region.

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Sea Ice Report #34.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
23/08/2018

Davis Station

Figure 1 shows a visible scene of Davis Station and the Vestfold Hills and surrounds.

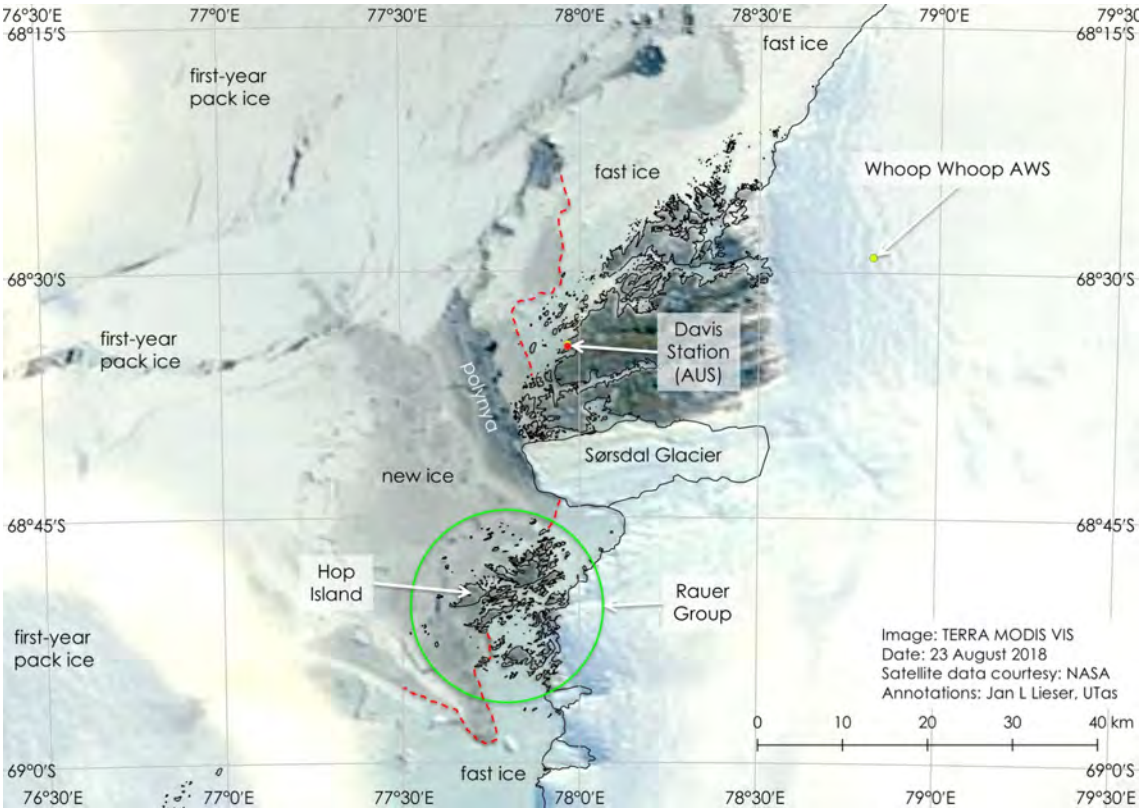

Figure 1: *TERRA MODIS VIS scene acquired 23/08/2018 and provided by NASA.*

Off the Vestfold Hills and the Rauer Group (green circle), recent fast ice break-up lines have been marked by dashed red lines. To the west of these lines, broken ex-fast ice has accumulated and appears to be re-attached (at least off the Vestfold Hills). The distribution, properties and condition of fast ice between the islands of the Rauer Group can not be determined from the imagery of Figure 1.

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Sea Ice Report #35.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
31/08/2018

Davis Station

Figure 1 shows a SAR scene of Davis Station and the Vestfold Hills and surrounds.

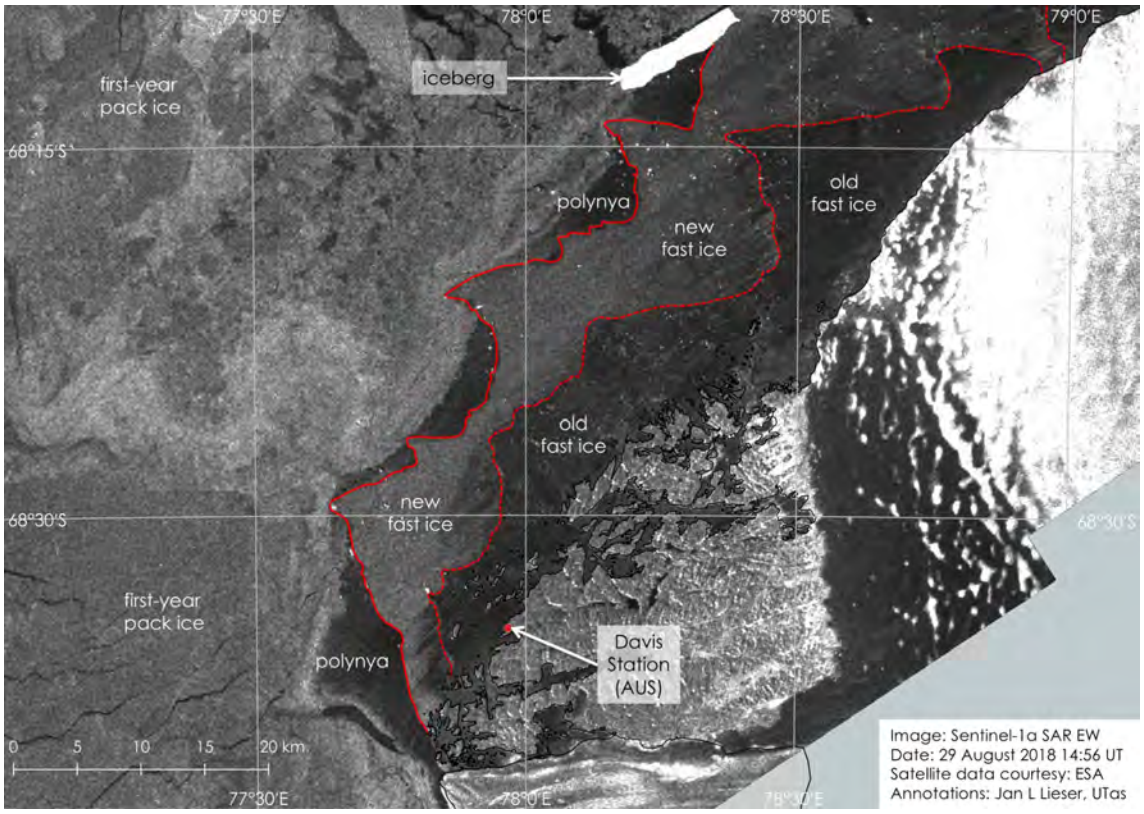

Figure 1: *Sentinel-1a SAR EW scene acquired 29/08/2018 at 14:46 UT and provided by ESA.*

Off the Vestfold Hills, recent fast ice accretion has been marked between the dashed and solid red lines. This fast ice has not grown in situ but comprises largely new and first-year sea ice that is held in place by many small, offshore grounded icebergs. Areas marked as 'old fast ice' have remained intact during the recent weather conditions, which caused wide-spread fast-ice break up in early August (see Sea Ice Report #32.1/2018).

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Sea Ice Report #36.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/09/2018

Mawson Station

Figure 1 shows a SAR scene of Mawson Station and the fast ice offshore.

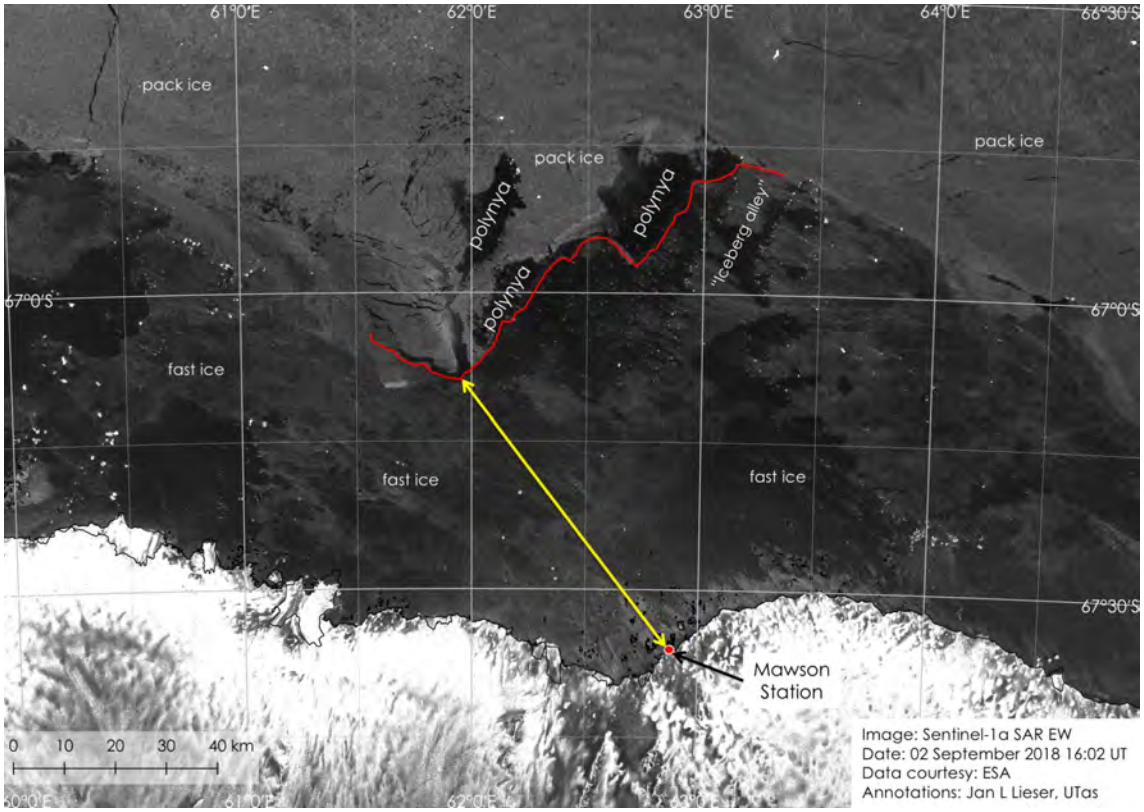

Figure 1: *Sentinel-1a SAR EW scene acquired 02/09/2018 at 16:02 UT and provided by ESA.*

North of Mawson Station, fast ice has started to break off. The fast-ice edge is approximated by the red scribble line and the shortest distance to the nearest open water is now 36 nautical miles to the northwest (compare Sea Ice Report #30.1/2018).

The shore-fast sea ice shows many different RADAR signatures, which points to different formations regimes and varying surface topographies.

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Davis Station

Figure 2 shows a visible scene of Davis Station and the Vestfold Hills and surrounds.

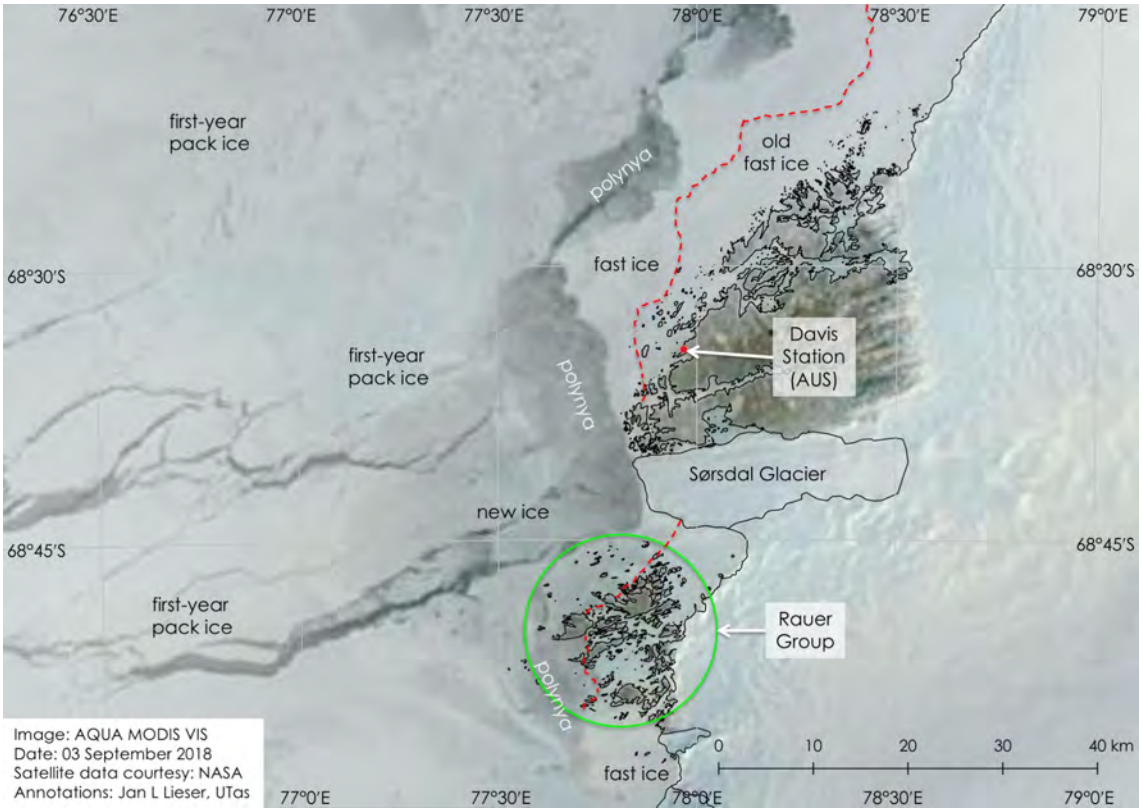

Figure 2: *AQUA MODIS VIS scene acquired 03/09/2018 and provided by NASA.*

Off the Vestfold Hills and the Rauer Group, polynyas appear temporarily frozen over and covered by new sea ice. West of Davis Station, the new fast-ice edge (see Sea Ice Report #34.2/2018) started to migrate towards the shore and is roughly 4.5 nautical miles away from the station.

Off the Rauer Group, the boundary of old fast ice is only roughly approximated (dashed red line) and new sea ice covers the polynya

Sea Ice Report #40.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/10/2018

Davis Station

Figure 1 shows a SAR scene of Davis Station and the fast ice offshore.

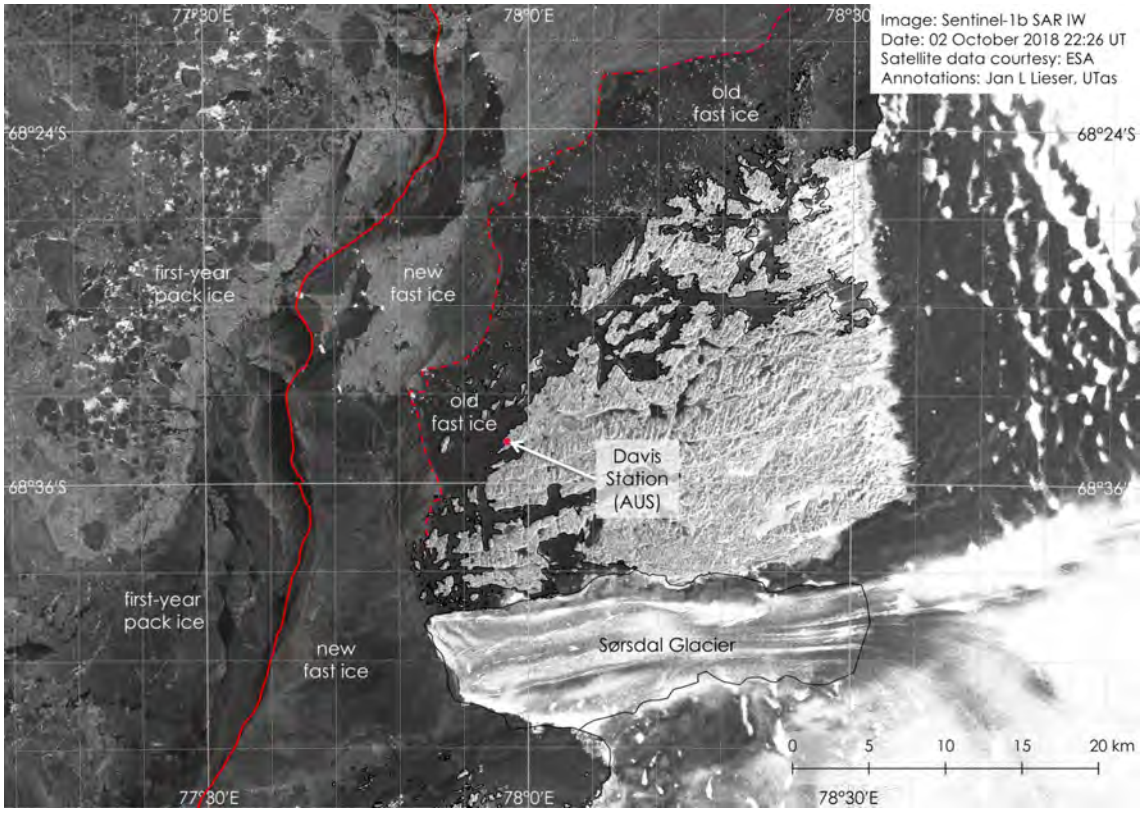

Figure 1: *Sentinel-1b SAR IW scene acquired 02/10/2018 at 22:26 UT and provided by ESA.*

West of Davis Station, fast ice has grown further offshore during the past month. The distance from the station to the fast-ice edge is now roughly 7.5 nautical miles, of which approximately 4.5 nautical miles consist of newly accreted pack ice.

In the north, the pack-ice edge is about 670 nautical miles away from the station, which is close to 10 nautical miles short of the September and October median sea-ice extent (both of which are very close to each other in this region at this time of year).

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D'Urville Sea

Figure 2 shows a visible scene of Commonwealth Bay/Cape Denison and surrounds.

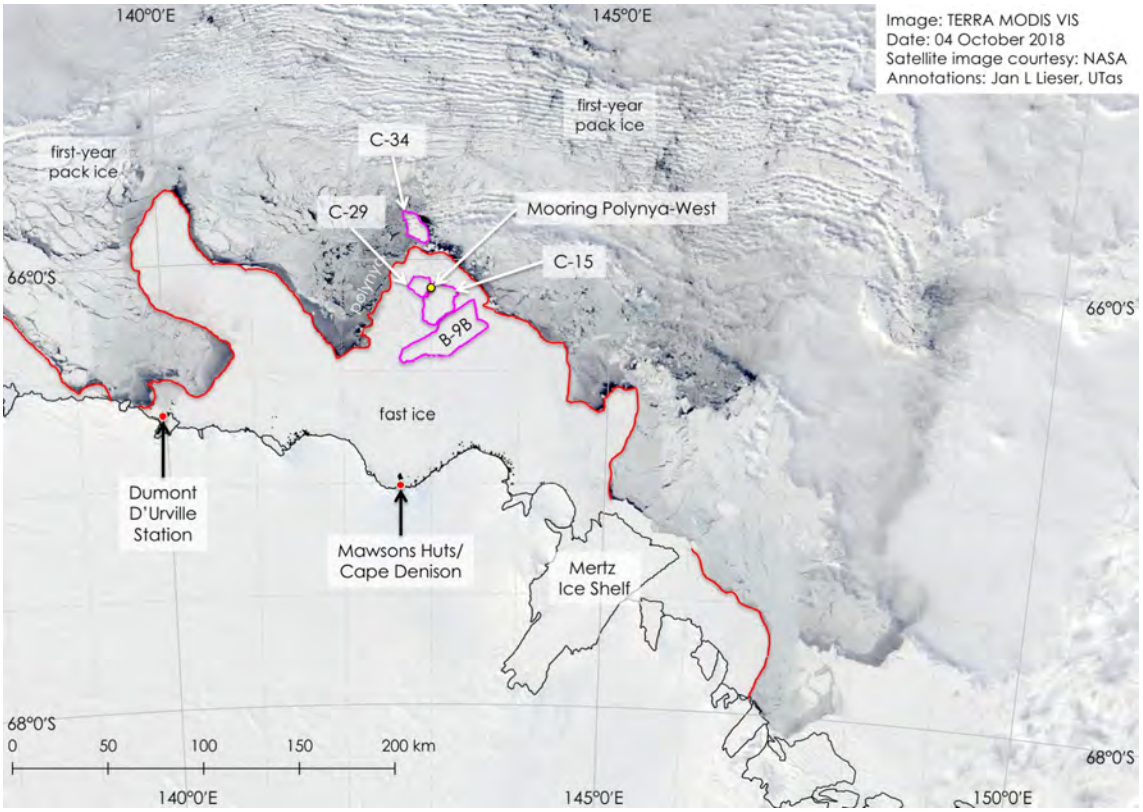

Figure 2: *TERRA MODIS VIS scene acquired 04/10/2018 and provided by NASA.*

Between Dumont D'Urville Station and the Mertz Ice Shelf, fast ice has grown to a continuous sheet, which is made up of a very heterogenous mix of pack ice floes that are pinned in place by many smaller icebergs and three large tabular bergs (north of Cape Denison; note: iceberg C-34 is grounded at its southern end but not enclosed by fast ice).

Sea Ice Report #42.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
15/10/2018

Davis Station

Figure 1 shows a SAR scene of Davis Station and the fast ice offshore (resampled to 100 m resolution). A large, grounded iceberg is marked with a pink outline north of the Vestfold Hills.

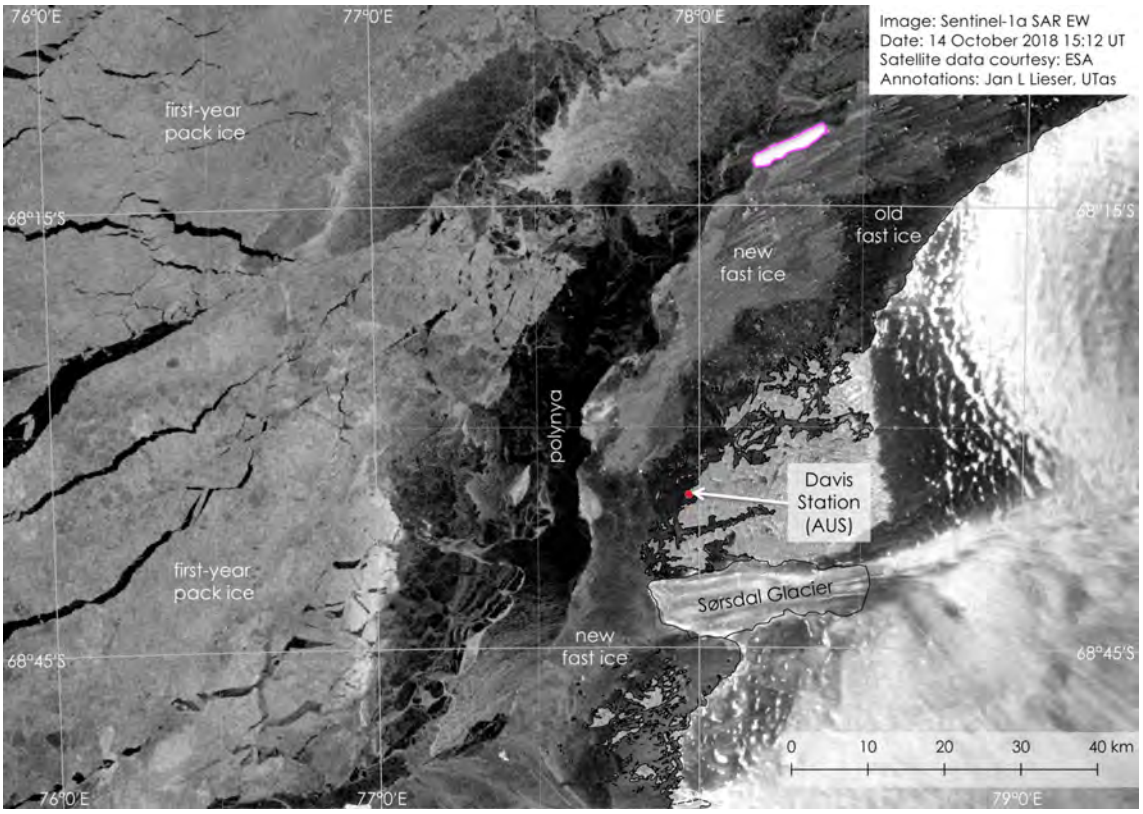

Figure 1: *Sentinel-1a SAR EW scene acquired 14/10/2018 at 15:12 UT and provided by ESA.*

West of the station, the fast-ice edge is now roughly 7.8 nautical miles offshore, of which almost 5 nautical miles consist of recently accreted pack ice.

In the north, the pack-ice edge is still 670 nautical miles away from the station, which remains close to 10 nautical miles short of the October median sea-ice extent.

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Figure 2 shows the same geographical frame as Figure 1, but visible data.

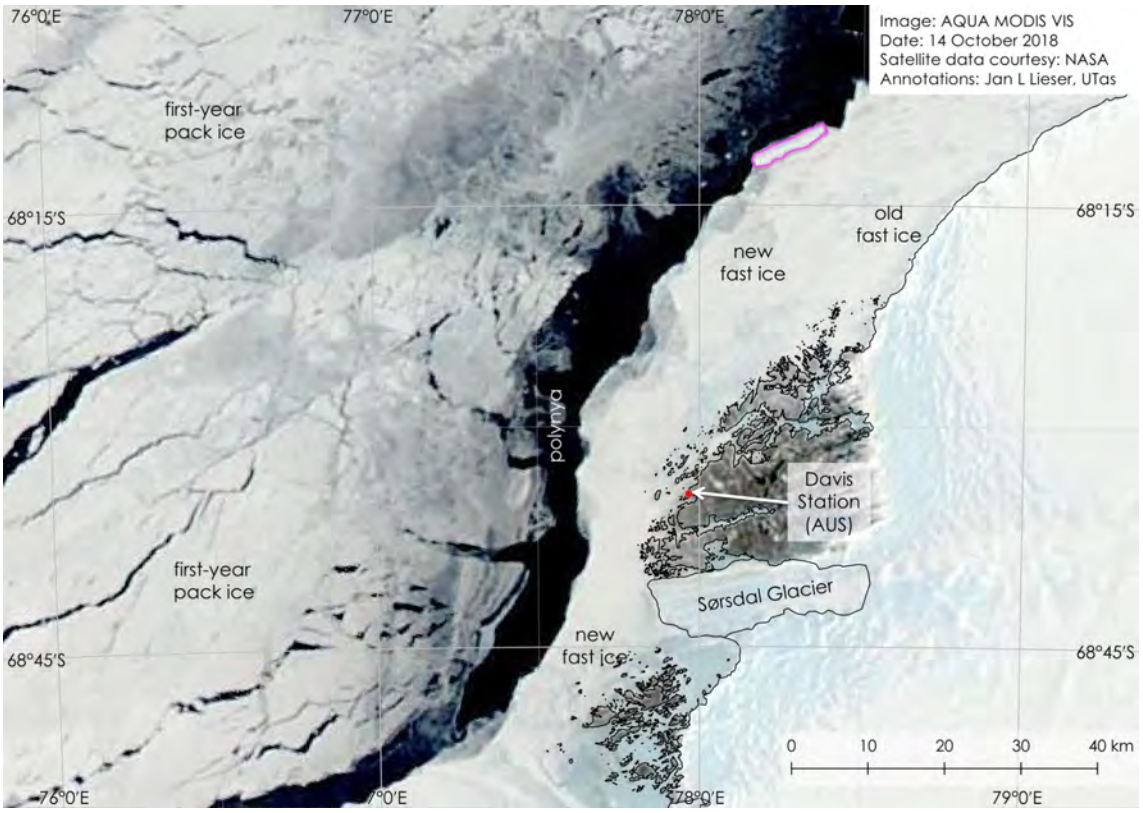

Figure 2: *AQUA MODIS VIS scene acquired 14/10/2018 and provided by NASA.*

This scene highlights that while the fast-ice edge appears to be of thinner ice thickness, the heterogeneous structure if the interior fast ice is only exposed by the RADAR scene (Figure 1).

Sea Ice Report #42.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
16/10/2018

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for September 2018.

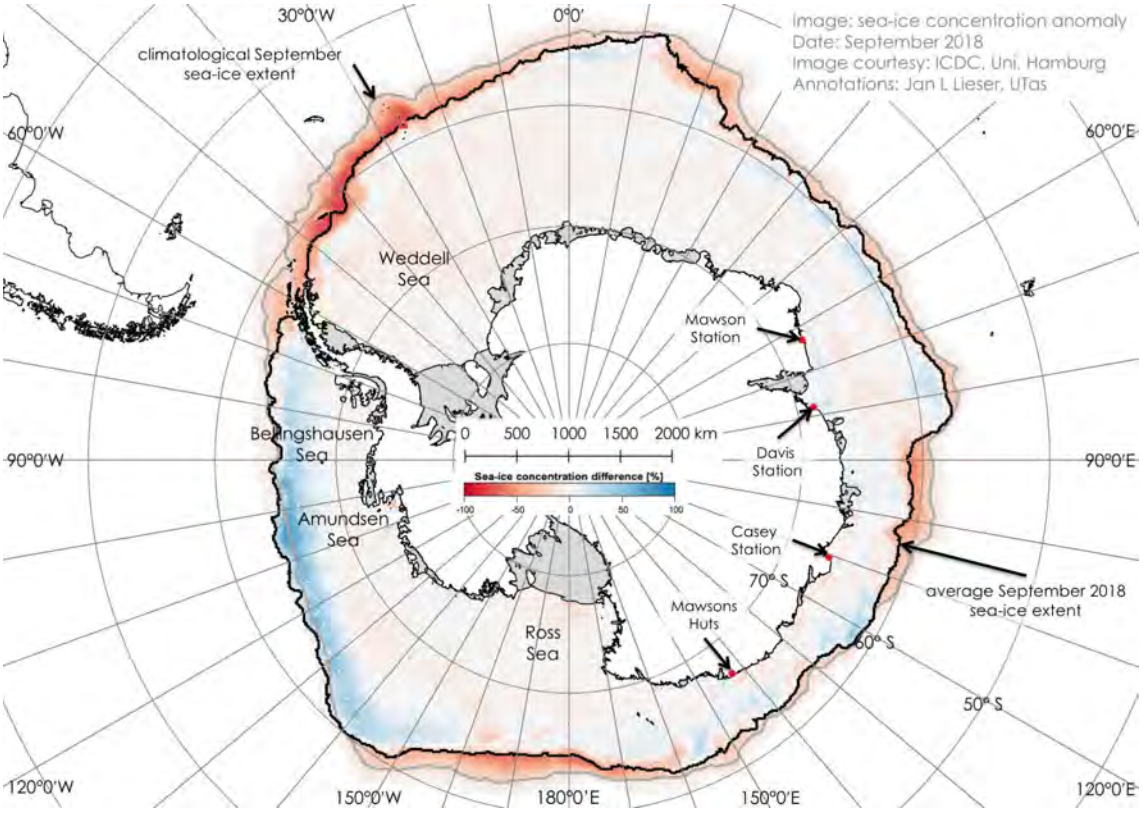

Figure 1: *Sea-ice concentration anomaly for September 2018 provided by ICDC, Universität Hamburg.*

In September 2018, sea-ice extent and concentration remain below average conditions throughout most of Antarctica (relative to 1992-2017). The western Weddell Sea shows the strongest negative anomaly, but parts of East Antarctica and the central Ross Sea follow closely (in terms of magnitude).
In the Bellingshausen Sea, sea-ice extent was close to average, while in the Amundsen Sea it was slightly above average, and both regions show above average sea-ice concentration within the extent. The northern tip of the Antarctic Peninsula is still below average extent and concentration.

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Sea Ice Report #42.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
16/10/2018

Davis Station

Figure 1 shows a high-resolution (30 m horizontal) visible scene of Davis Station and the fast ice offshore. A cloud shadow is marked by a blue ellipse and vehicle tracks can be seen offshore (green ellipse). The edge between old (more than three months old) and newer (roughly two months old) fast ice is marked by a red, dashed scribble line.

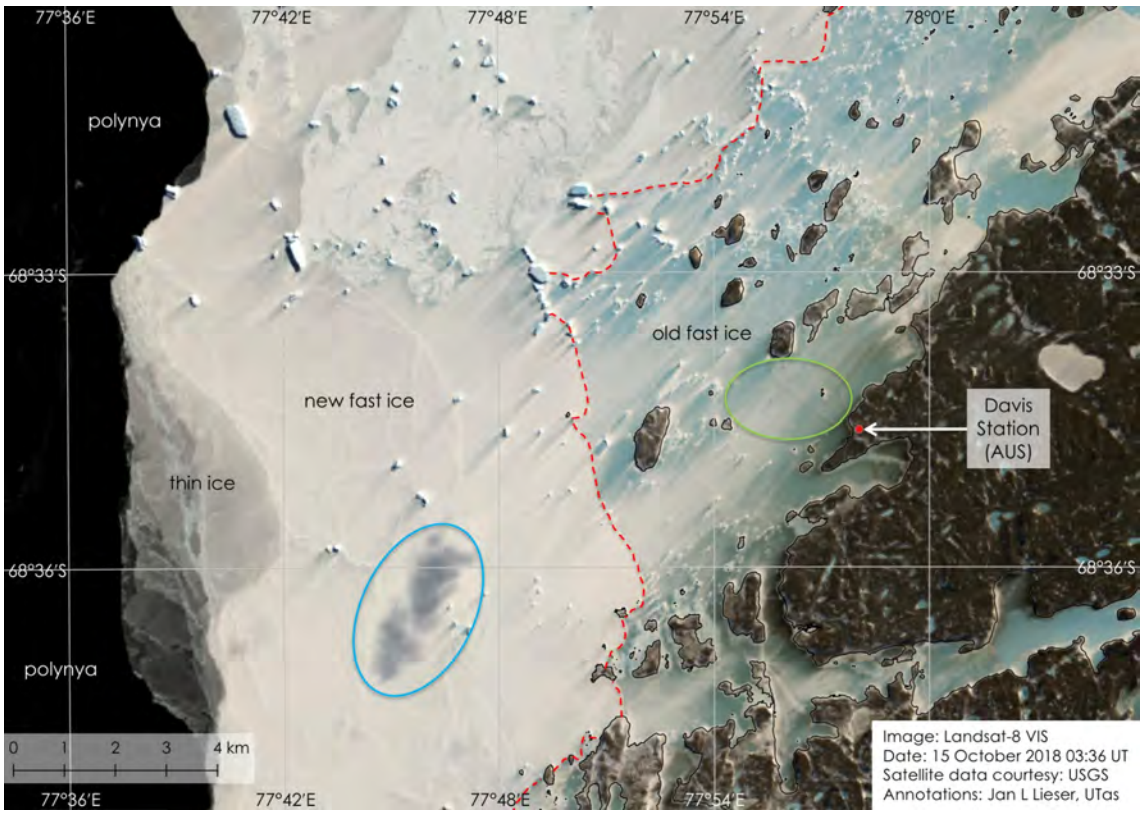

Figure 1: *Landsat-8 visible composite scene acquired 15/10/2018 at 03:36 UT and provided by USGS.*

The surface of the new fast ice shows ridge structures of floe edges when they aggregated onto the old fast ice, and it shows re-frozen tide cracks spanning between icebergs. The western edge of the new fast ice appears thin where the dark (black) ocean shines through (thinner sea ice shows darker shades).

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Casey Station

Figure 2 shows a high-resolution SAR scene of Casey Station and offshore.

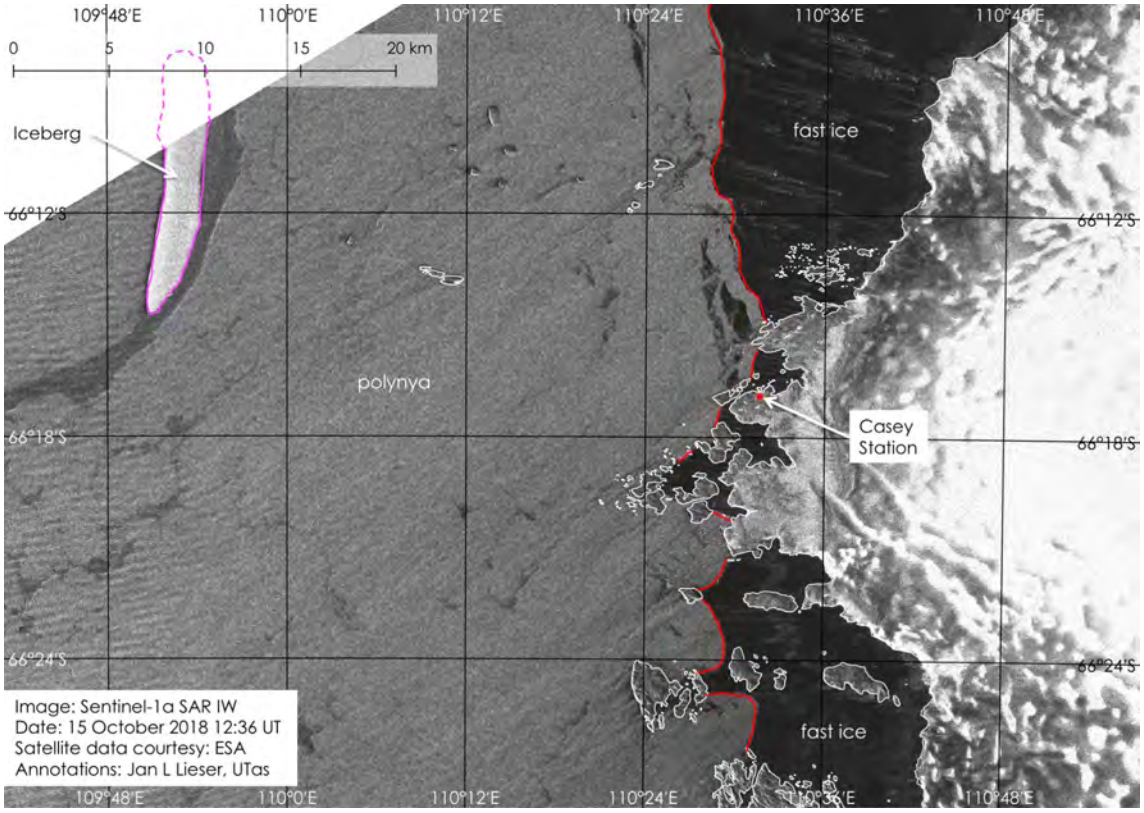

Figure 2: *Sentinel-1a SAR IW scene acquired 15/10/2018 at 12:36 UT and provided by PolarView.*

Most of the offshore fast ice has broken away from Casey Station, only between near-shore islands and promontories some land-fastened sea ice remains. Further offshore, a large (roughly 13 km long) tabular iceberg (pink shape) is drifting southward (currently about 1 km/h).

Sea Ice Report #42.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
19/10/2018

Mawson Station

Figure 1 shows a visible scene of Mawson Station and offshore.

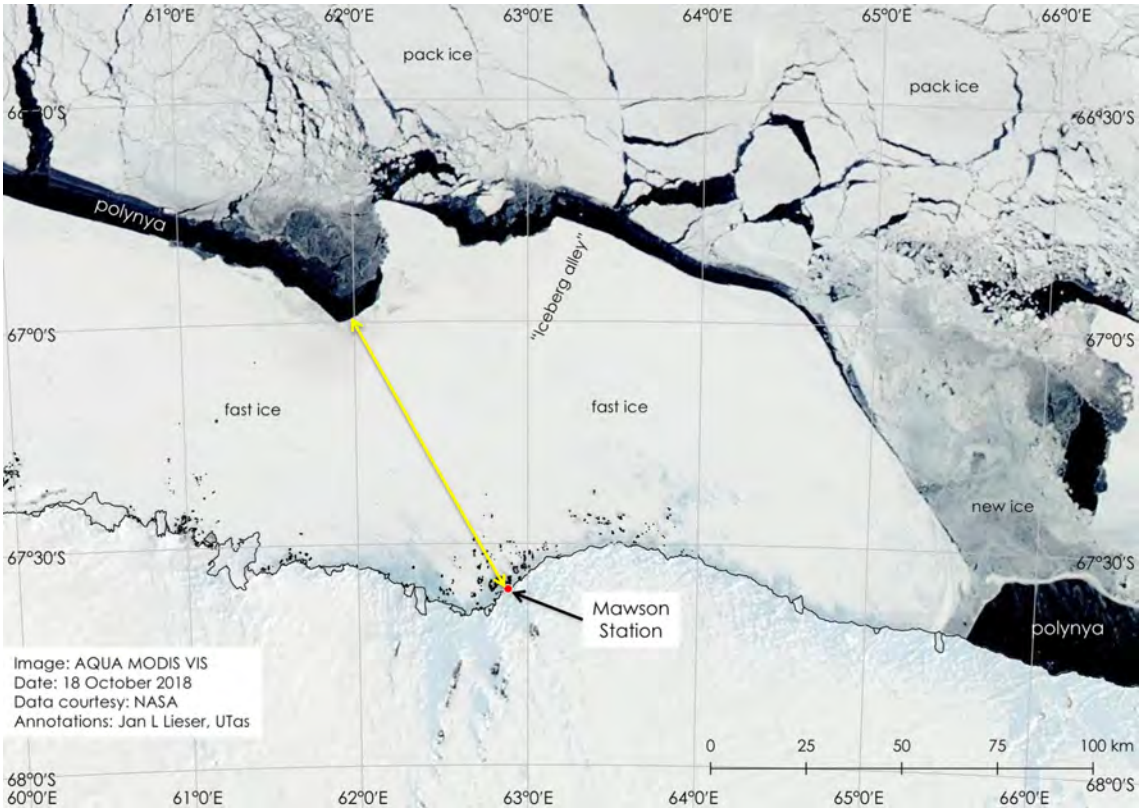

Figure 1: *AQUA MODIS VIS scene acquired 18/10/2018 and provided by NASA.*

Off Mawson Station, the fast-ice edge has roughly its typical shape for the time of year. but the closest distance to open water (the so-called northwest polynya) is approximately 44 nautical miles, which is slightly further offshore than typical.

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Davis Station

Figure 2 shows a SAR scene of Davis Station and the fast ice offshore. The fast-ice edge from 15/10/2018 is marked by a red, dashed line, the current edge is marked by a solid red line. A large tabular iceberg (pink outline) is grounded north of the Vestfold Hills.

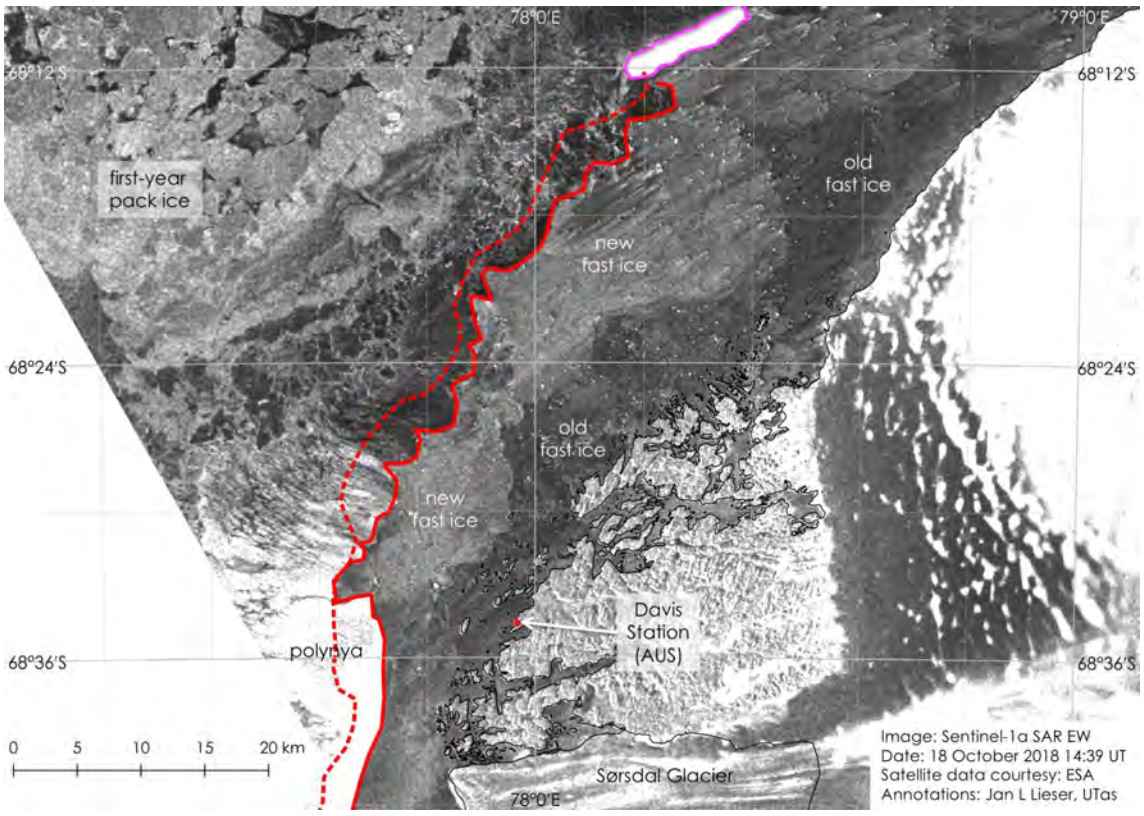

Figure 2: *Sentinel-1a SAR EW scene acquired 18/10/2018 at 14:39 UT and provided by PolarView.*

Recent weather has broken off fast ice from the edge off the Vestfold Hills, which moved the edge approximately 2.1 nautical miles closer to shore, west of the Davis Station.

Sea Ice Report #43.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
24/10/2018

Davis Station

Figure 1 shows a sea-ice concentration chart of East Antarctica.

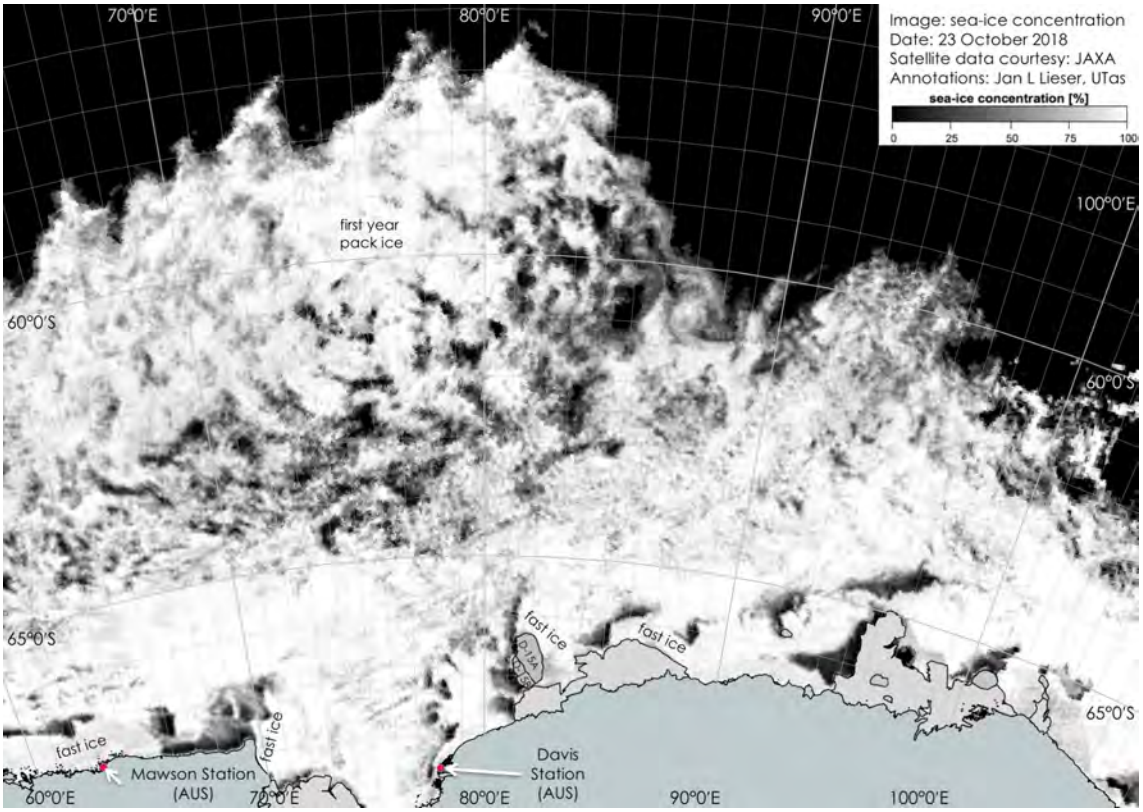

Figure 1: *Sea-ice concentration chart acquired 23/10/2018 and provided by ICDC, Universität Hamburg.*

A large low pressure system passed recently north of the sea-ice edge and has loosened the pack ice slightly, dragging it northward after the centre of the Low moved eastward.

As a result, low sea-ice concentration reaches down to 65° S north of the Amery Ice Shelf. However, some very large floes of old sea ice (likely ex-fast ice) are still within this lower sea-ice concentration matrix.

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Sea Ice Report #44.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
29/10/2018

Davis Station

Figure 1 shows a sea-ice concentration chart of East Antarctica.

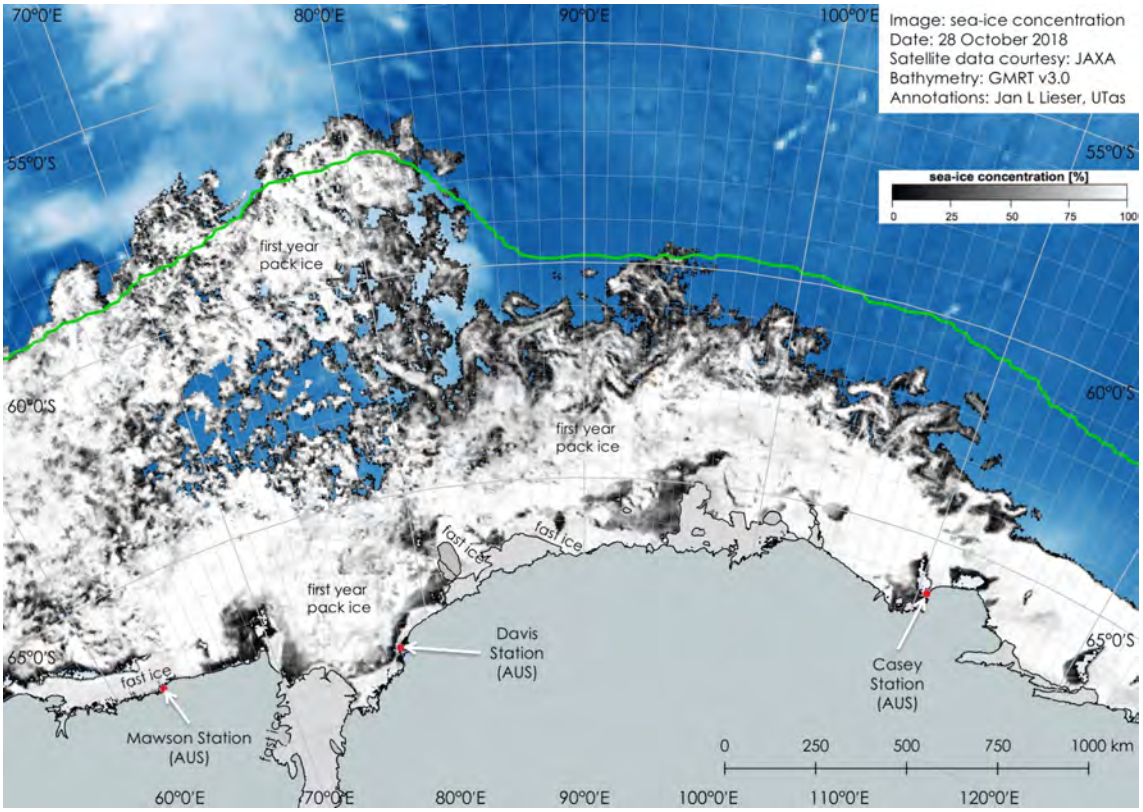

Figure 1: *Sea-ice concentration chart acquired 28/10/2018 and provided by ICDC, Universität Hamburg.*

West of 85° E, the northward expansion of sea ice continues beyond the October median sea-ice extent (green line in Figure 1) in the region. But this northward drift of sea ice has opened large areas of very open ice within the central first-year pack ice. As a result locally, up to 'open water' conditions reach down to 65° S north of the Amery Ice Shelf. However, some very large floes of old sea ice (likely ex-fast ice) are still within this low sea-ice concentration matrix.

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Sea Ice Report #44.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
30/10/2018

Casey Station

Figure 1 shows a SAR scene off Casey Station.

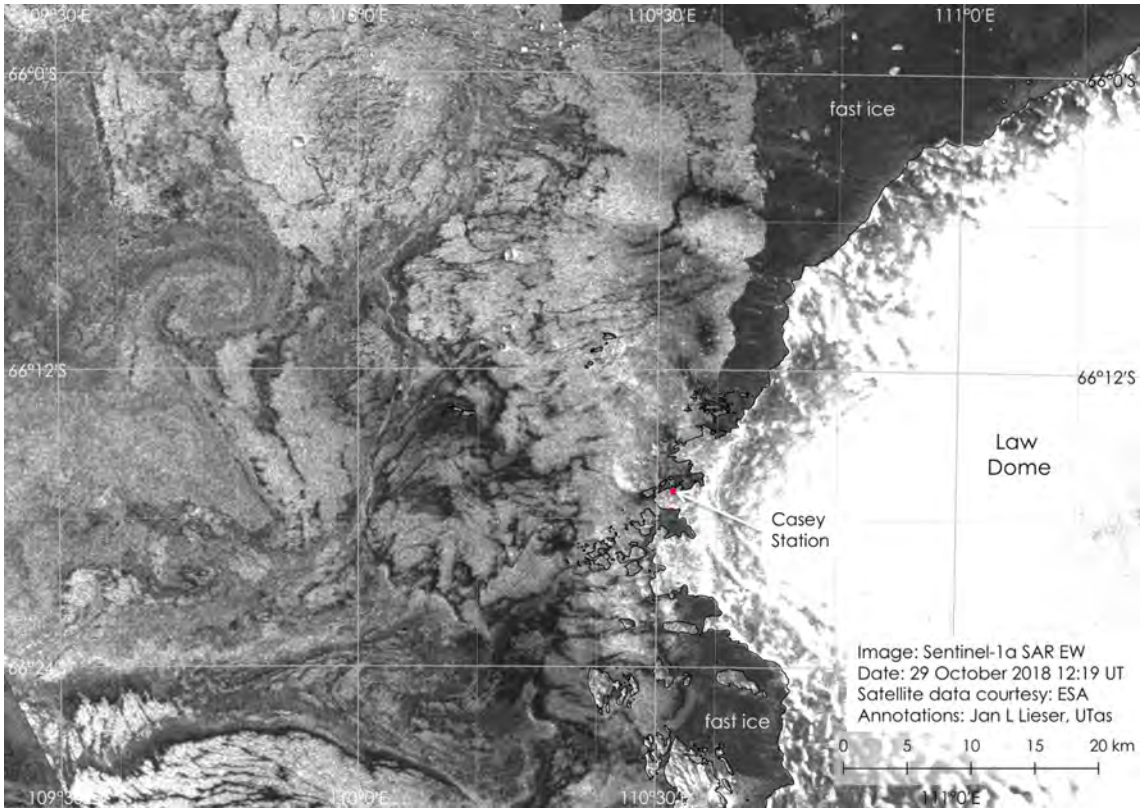

Figure 1: *Sentinel-1a SAR EW acquired 29/10/2018 at 12:19 UT and provided by PolarView.*

Off Casey Station, new and frazil sea ice creates a range of different patterns in the polynya due to the range of different textures of the sea ice combined with ripples of the open water surface. Isolated smaller icebergs can be identified in the mix.

North and south of the station, only little fast ice remains attached to Law Dome.

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Larsen-C Ice Shelf

Figure 2 shows a very high-resolution (10 m horizontal) visible scene off the Larsen-C ice shelf of the Antarctic Peninsula.

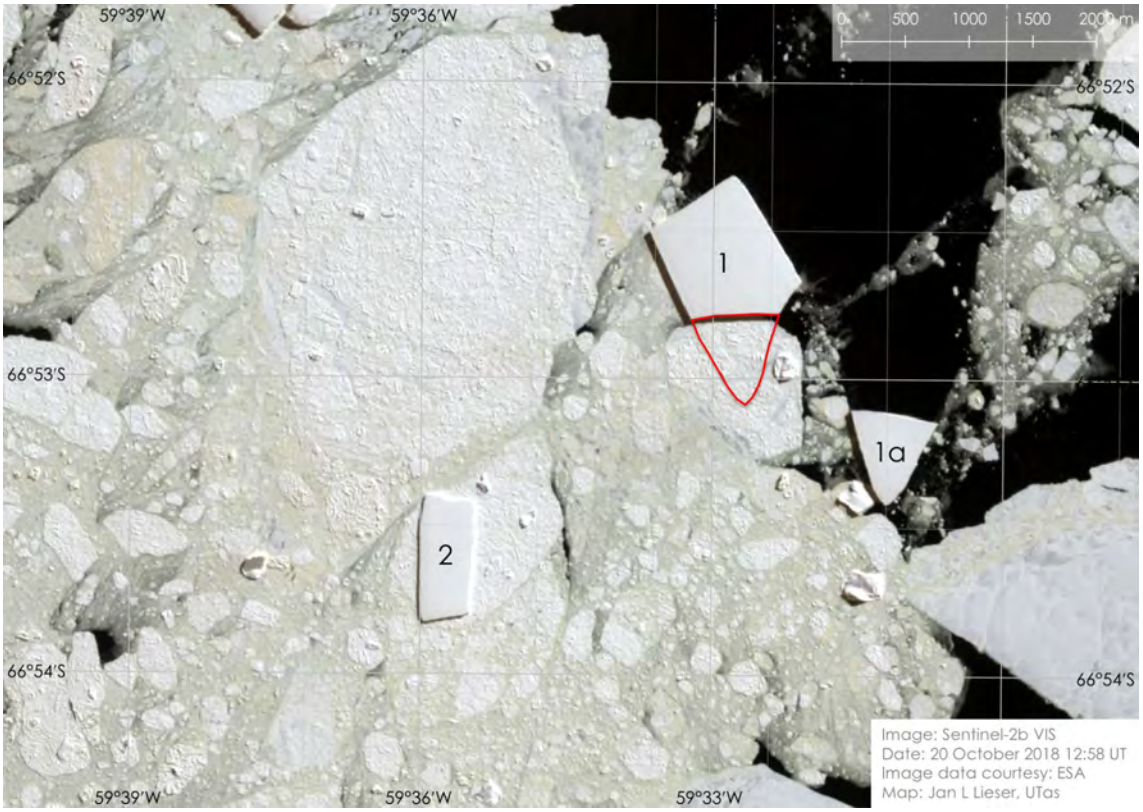

Figure 2: *Sentinel-2b VIS composite acquired 20/10/2018 at 12:58 UT and provided by USGS.*

Earlier this month, an Operation Icebridge scientist reported curiously straight shaped icebergs off the Larsen-C ice shelf. The image shown in Figure 2 was acquired four days after the aircraft's overflight.

A pentagon-shaped iceberg (marked '1') shows rather straight sides and the two northern corners are at almost perfect 90-degree angles. The triangle-shaped berg (marked '1a') was part of iceberg '1' when it was spotted by the plane. The red shape indicates its original position. This original iceberg had a size of little more than 1 km^2. A smaller, more rectangular iceberg (marked '2') is roughly 0.3 km^2.

A yellow discolouration of brash ice between the icebergs and larger sea-ice floes indicates early spring biological activity.

Sea Ice Report #44.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
31/10/2018

D'Urville Sea

Figure 1 shows a SAR scene of Commonwealth Bay/Cape Denison and surrounds.

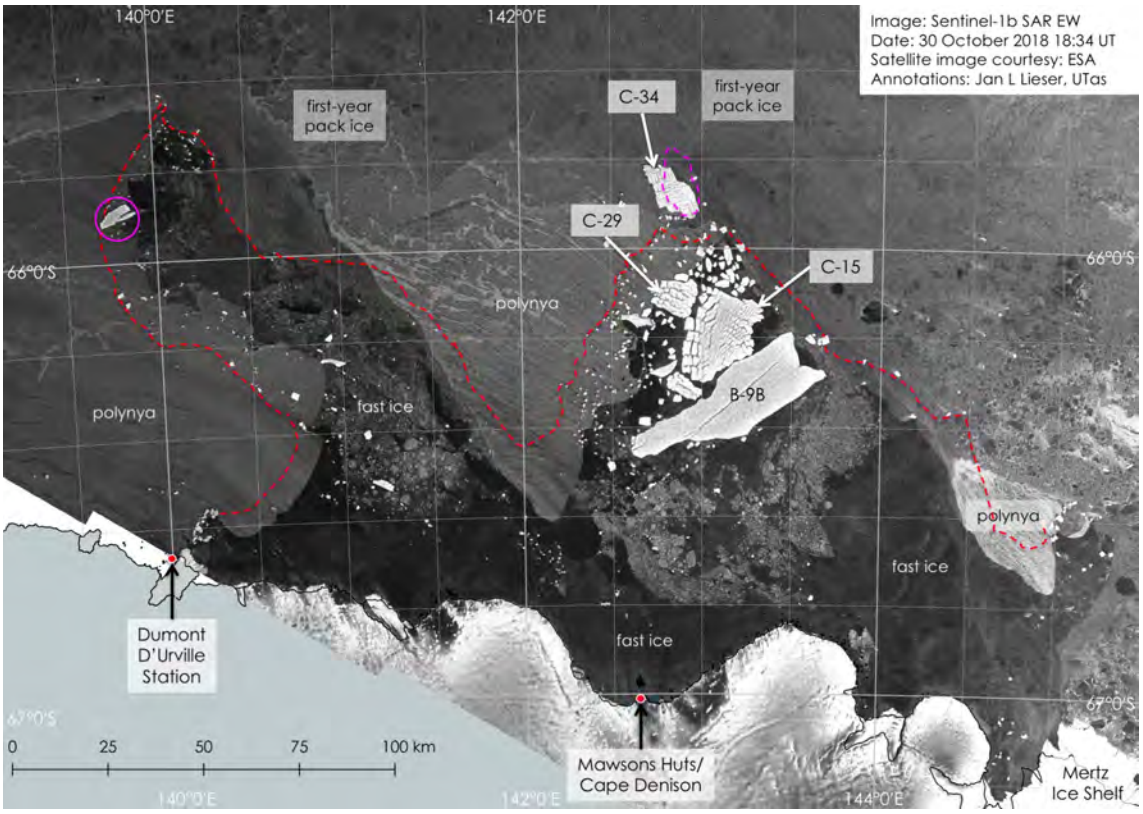

Figure 1: *Sentinel-1b SAR EW scene acquired 30/10/2018 at 18:34 UT and provided by PolarView.*

Between Dumont D'Urville Station and the Mertz Ice Shelf, fast ice is starting to break up. The fast-ice edge from 18/10/2018 is indicated by the red, dashed line. While three large tabular icebergs remain very close to each other north of Cape Denison, iceberg C-34 appears grounded at its southern end and continues to swivel.
North of Dumont D'Urville Station, an iceberg (marked by a pink circle) has broken into two pieces and started to turn south. Beyond the polynya off the station, first year pack ice extends roughly 115 nautical miles northward.

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Sea Ice Report #44.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
02/11/2018

Davis Station

Figure 1 shows a sea-ice concentration chart of East Antarctica. Green contours mark 10% sea-ice concentration limits based on the AMSR-2 data. The orange line shows the cruise track of RSV *Aurora Australis* (up to 02/11/2018 00:00 UT).

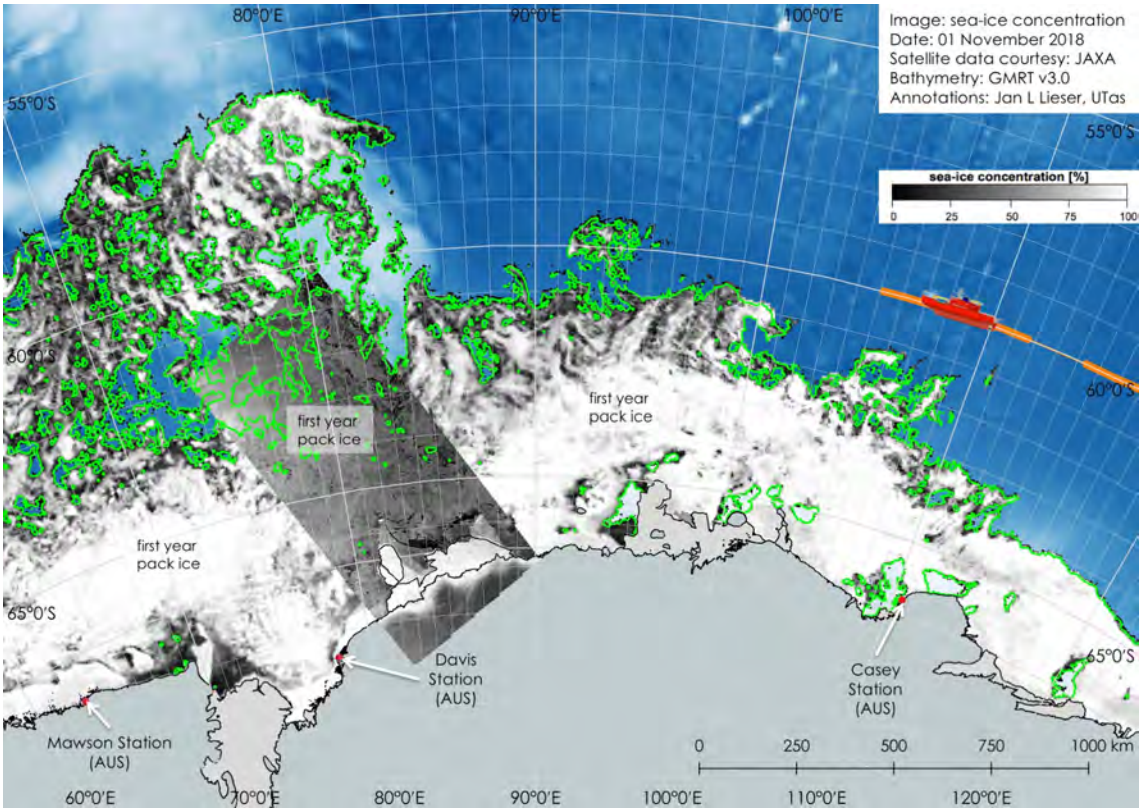

Figure 1: *Sea-ice concentration chart acquired 01/11/2018 and provided by ICDC, Universität Hamburg; overlay of Sentinel-1 SAR EW swath acquired on 01/11/2018 at 14:23 UT and provided by Drift+Noise Polar Services.*

South of 65° S, a band of high sea-ice concentration (higher than 80%) persists, which extends patches northward locally (see also Figure 2 for an enlarged view of the same sea-ice concentration data as shown in Figure 1, but a different colour scheme).

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However, some icebergs and very large floes of sea ice (likely ex-fast ice) are still within the lower sea-ice concentration matrix north of 65° S (as evident from the SAR data shown in Figure 1).

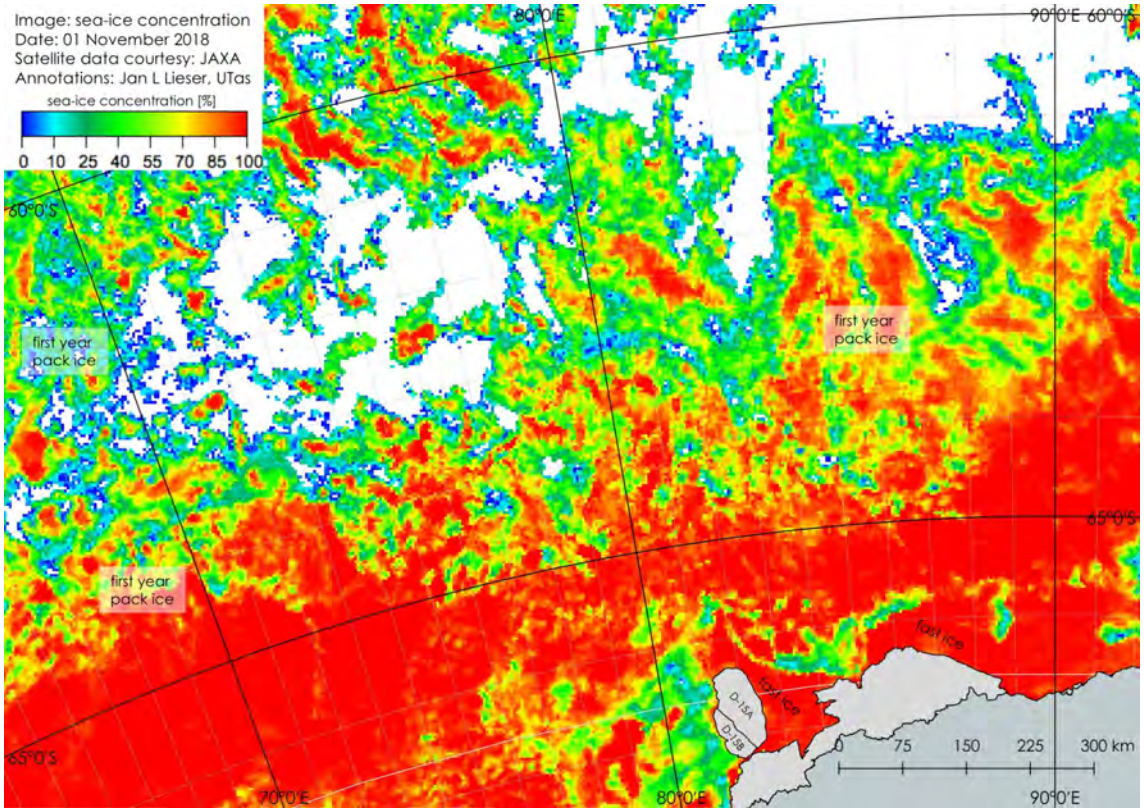

Figure 2: *Sea-ice concentration chart acquired 01/11/2018 and provided by ICDC, Universität Hamburg.*

Sea Ice Report #45.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
05/11/2018

Davis Station

Figure 1 shows a sea-ice concentration chart of East Antarctica. The orange line shows the cruise track of RSV *Aurora Australis* (up to 05/11/2018 02:00 UT).

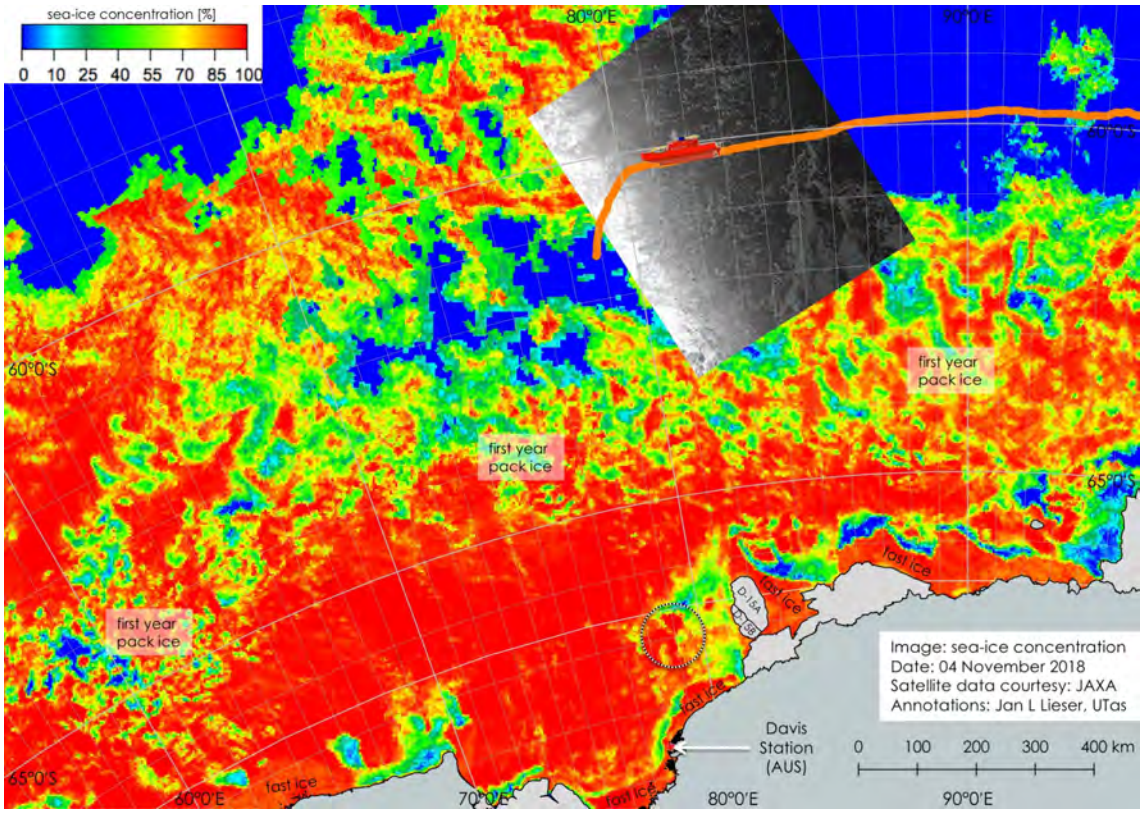

Figure 1: *Sea-ice concentration chart acquired 04/11/2018 and provided by ICDC, Universität Hamburg; overlay of Sentinel-1b SAR EW swath acquired on 04/11/2018 at 13:59 UT and provided by PolarView.*

South of 65° S, a band of high sea-ice concentration (higher than 80%) persists, which extends patches northward locally. Due to local weather this band shows a slight compaction, which results in higher sea-ice concentration within this band compared to the end of last week.

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West of the D-15 icebergs, lower sea-ice concentration can be found but at the western edge of this patch some fast ice has formed between grounded icebergs. Note: this fastened ice is not land-fast (marked by dashed circles in the figures)

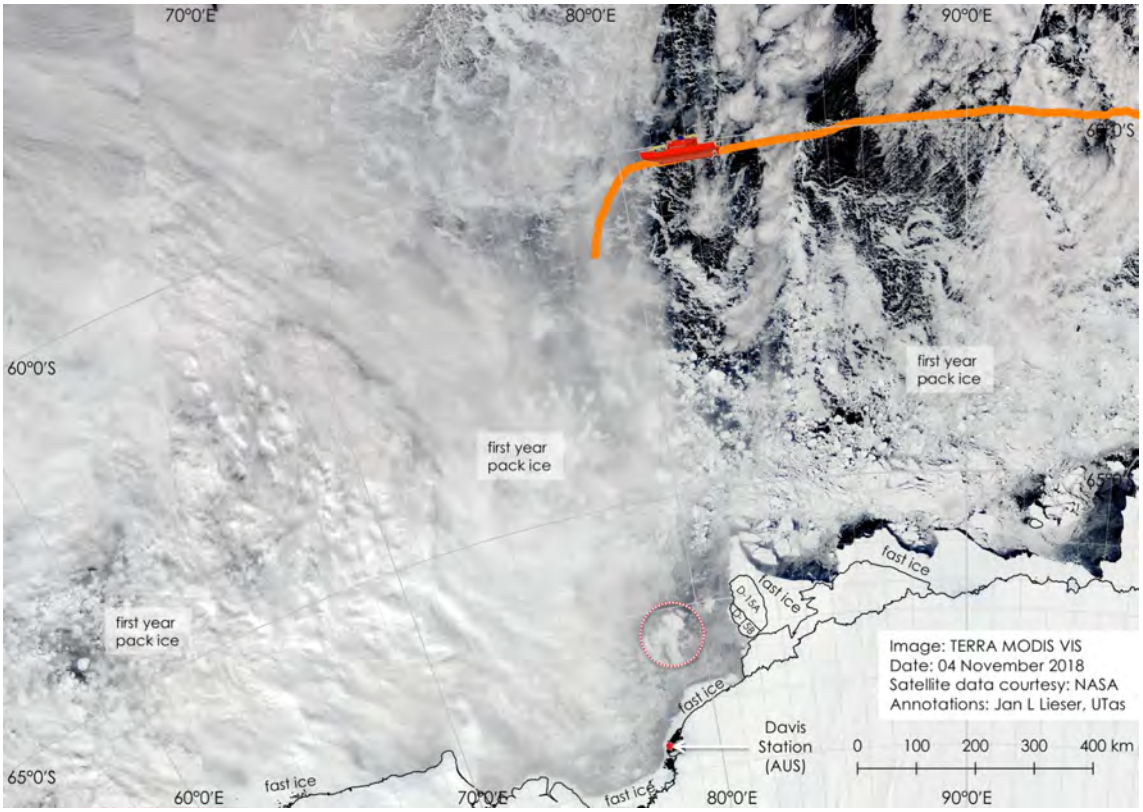

Figure 2: *TERRA MODIS VIS data acquired 04/11/2018 and provided by NASA.*

Sea Ice Report #45.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
06/11/2018

Davis Station

Figure 1 shows a high-resolution (40 m horizontal) SAR scene of eastern Cooperation Sea. The orange line shows the cruise track of RSV *Aurora Australis* (up to 05/11/2018 23:00 UT).

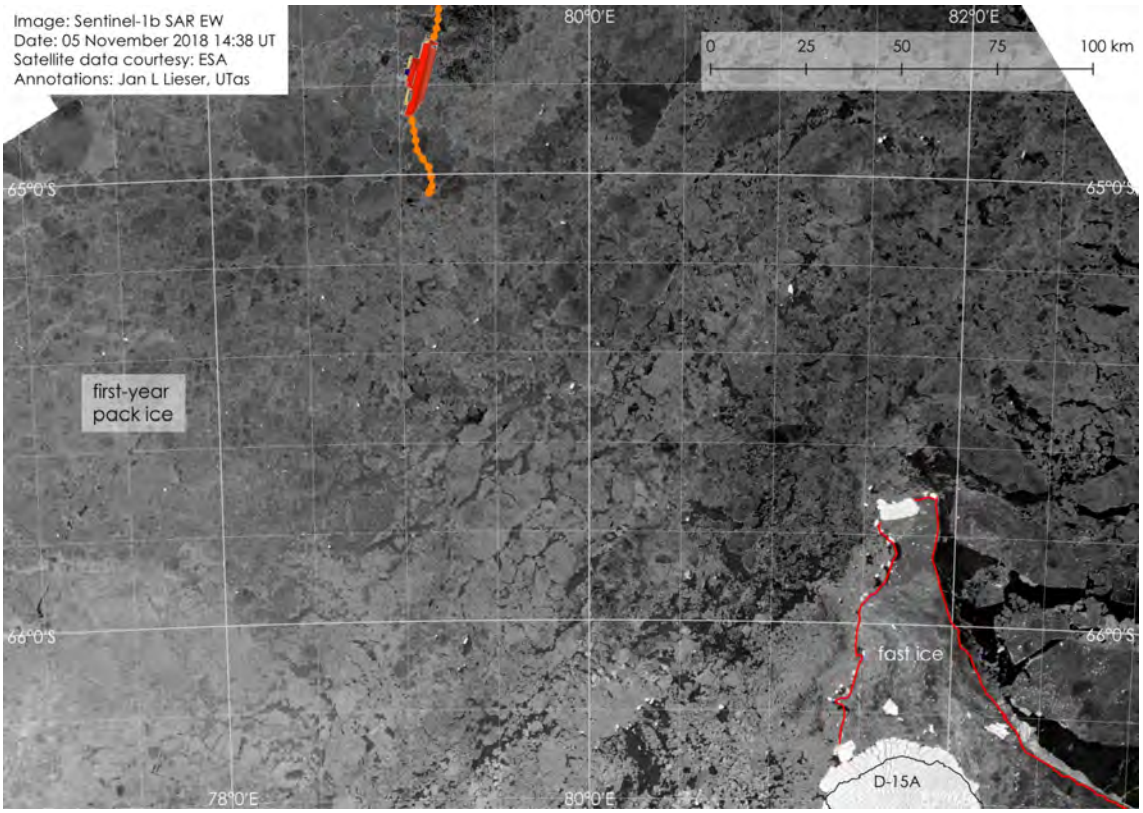

Figure 1: *Sentinel-1b SAR EW scene acquired 05/11/2018 at 14:38 UT and provided by Drift+Noise Polar Services.*

South of 65° S, a band of high sea-ice concentration (higher than 80%) stretches for another roughly 50 nautical miles south of the ship's indicated position. Further south from there, the sea ice appears a bit more open where leads and openings run southwest to northeast.

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Figure 2 shows the southern continuation of the same scene of Figure 1. Here, localised fast-ice patches that are not attached to the coast (see Sea Ice Report #45.1/2018) are marked.

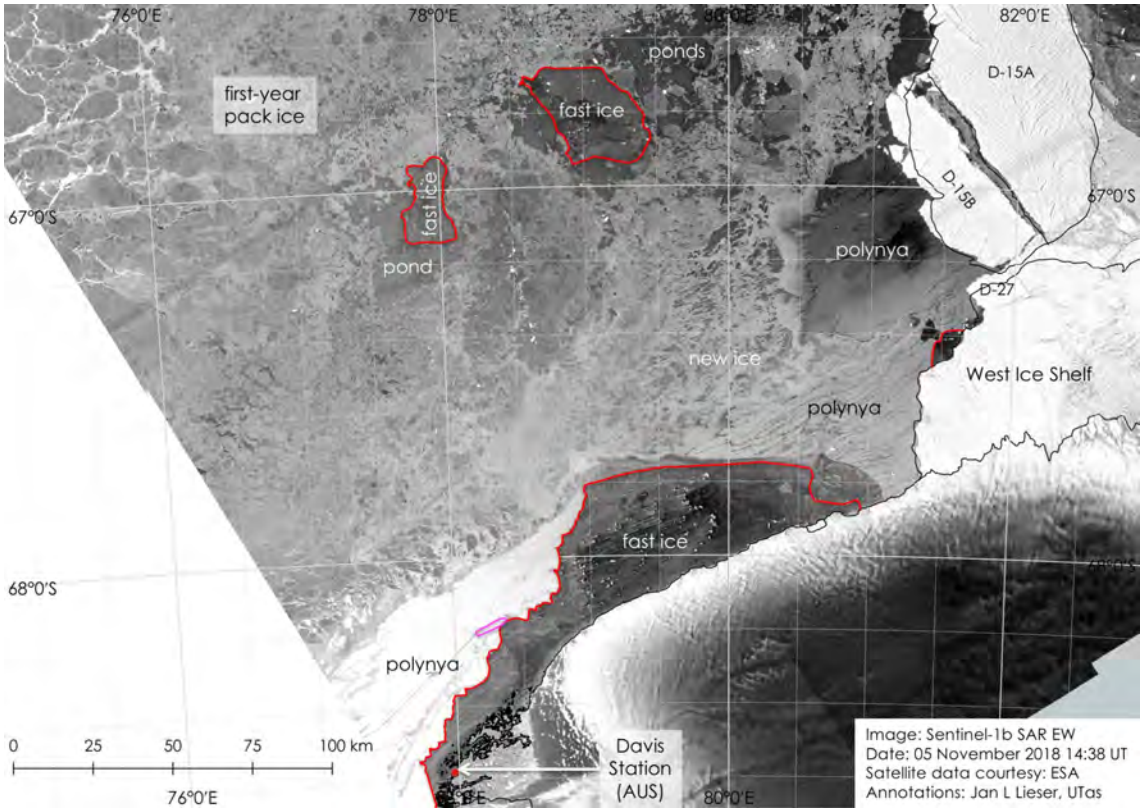

Figure 2: *Sentinel-1b SAR EW scene acquired 05/11/2018 at 14:38 UT and provided by Drift+Noise Polar Services.*

Sea Ice Report #45.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
08/11/2018

Davis Station

Figures 1 and 2 show the same geographical frame of high-resolution visible and SAR data, respectively, of Davis Station and the fast ice offshore. The orange line shows the cruise track of RSV *Aurora Australis* (up to 07/11/2018 05:00 UT).

The visible scene (Figure 1) is affected slightly by thin clouds and was acquired shortly before the vessel arrived at the fast-ice edge. The SAR scene (Figure 2) was acquired after the vessel had reached its position (marked by an orange circle in the Figure 2) for the resupply of the station.

The boundary between old fast ice near shore and younger fast ice further out is marked by a dashed red line.

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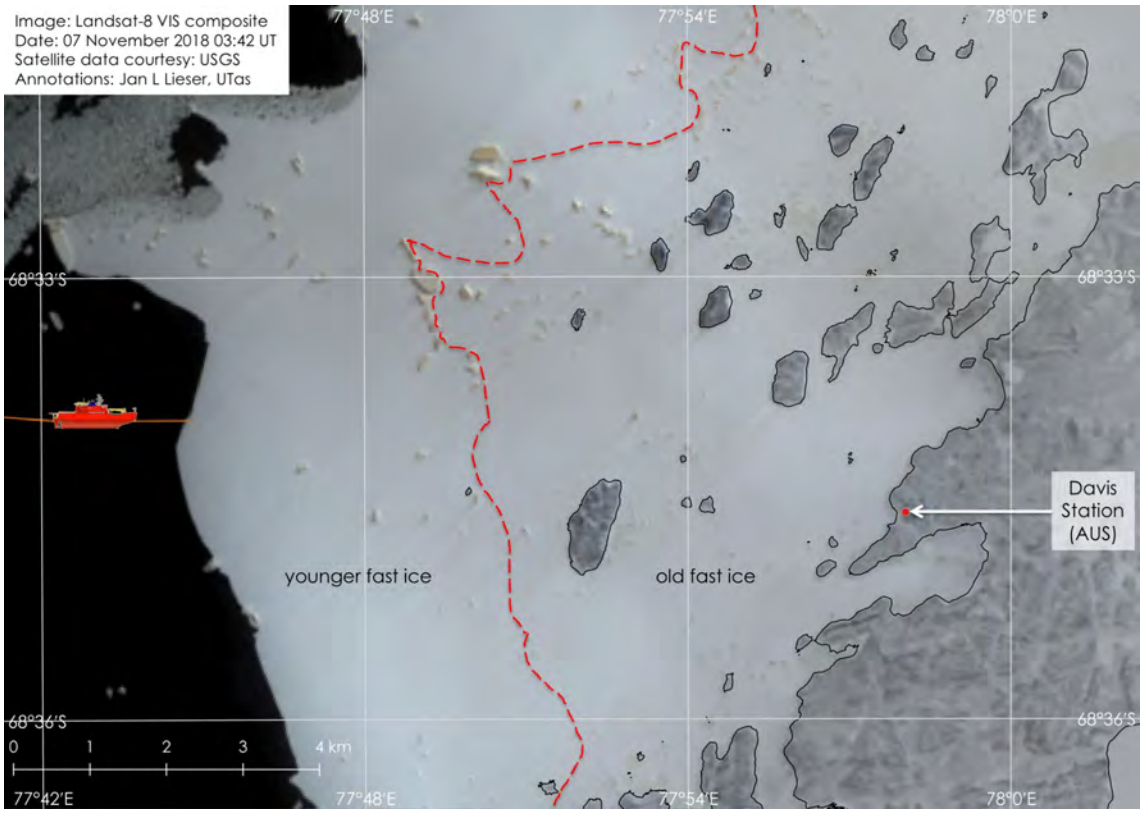

Figure 1: *Landsat-8 visible composite scene acquired 07/11/2018 at 03:42 UT and provided by USGS.*

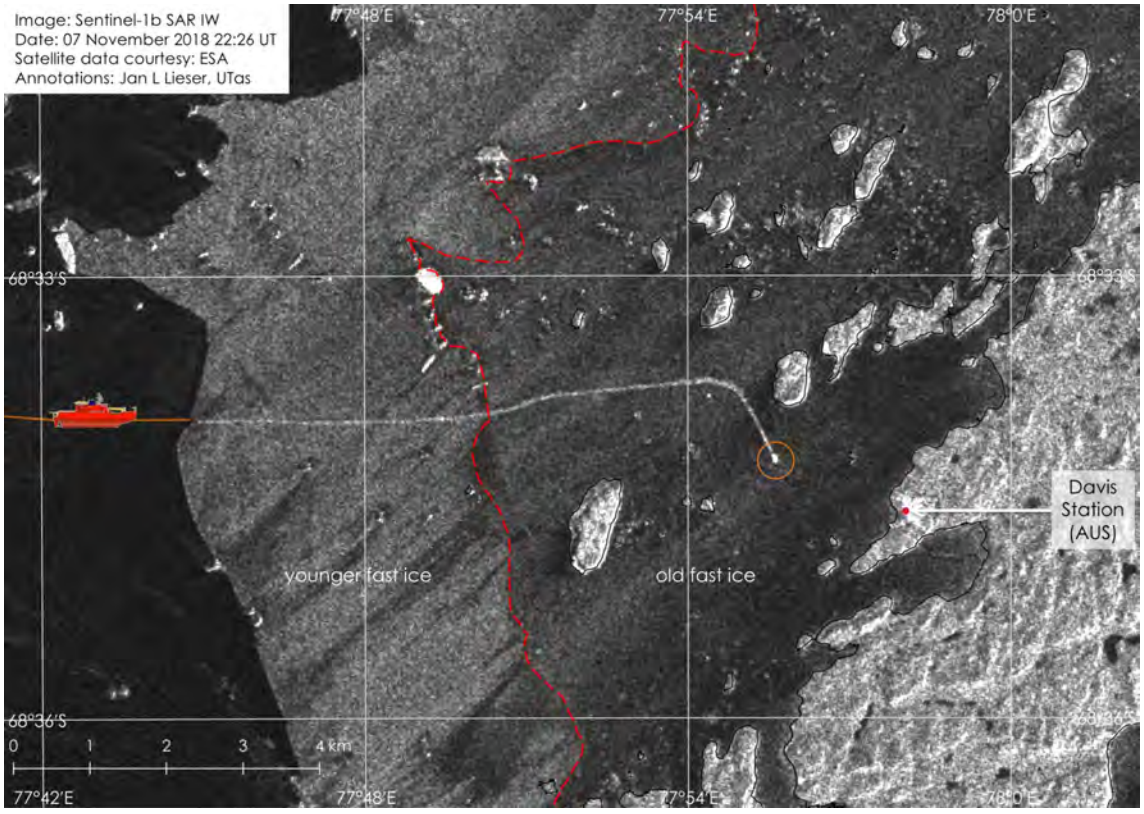

Figure 2: *Sentinel-1b SAR IW scene acquired 07/11/2018 at 22:26 UT and provided by PolarView.*

Sea Ice Report #46.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/11/2018

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for October 2018.

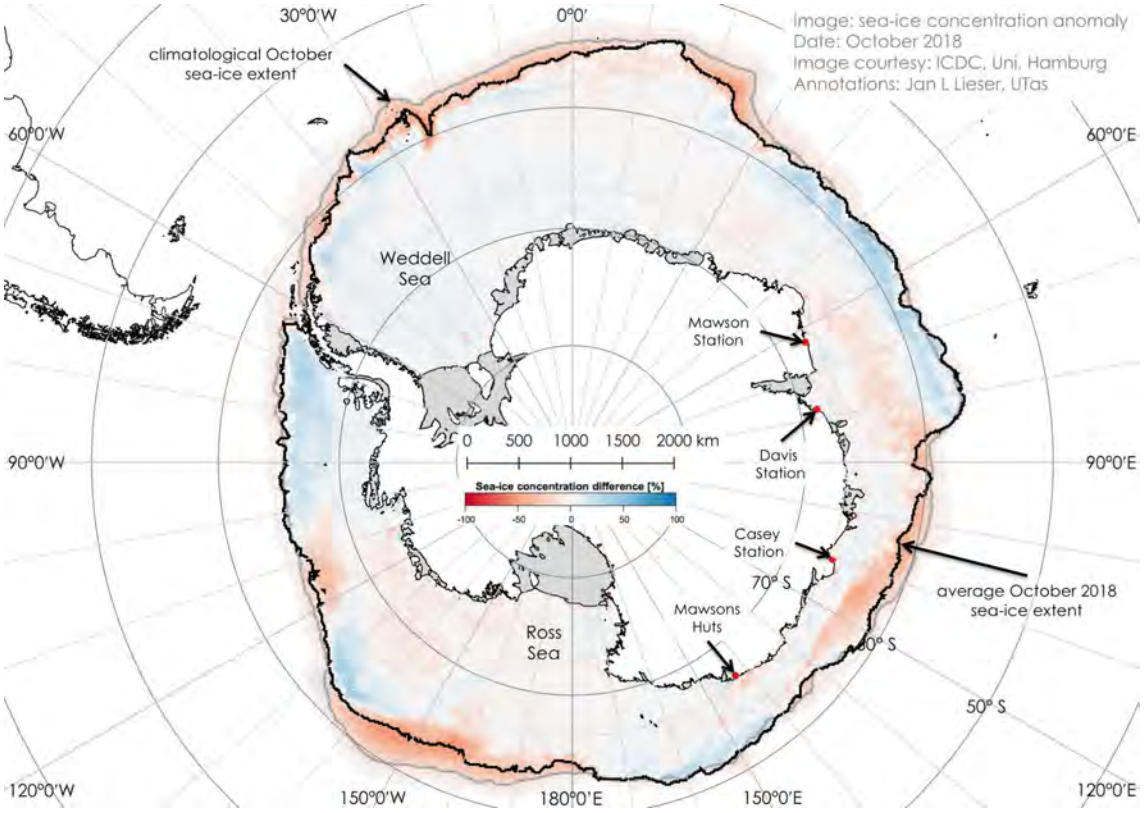

Figure 1: *Sea-ice concentration anomaly for October 2018 provided by ICDC, Universität Hamburg.*

In October 2018, sea-ice extent and concentration remain below average (relative to 1992-2017) conditions throughout most of Antarctica. The eastern and central Ross Sea shows the strongest negative anomaly in the marginal ice zone, but other regions around Antarctica follow closely (in terms of magnitude).
In East Antarctica, the central pack of sea-ice showed slightly below average sea-ice concentration, however the marginal ice zone west of 85° E had above average sea-ice concentration within average extent.

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Sea Ice Report #46.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/11/2018

Davis Station

Figure 1 show a very high-resolution visible scene (15 m horizontal) of Davis Station and the fast ice offshore.

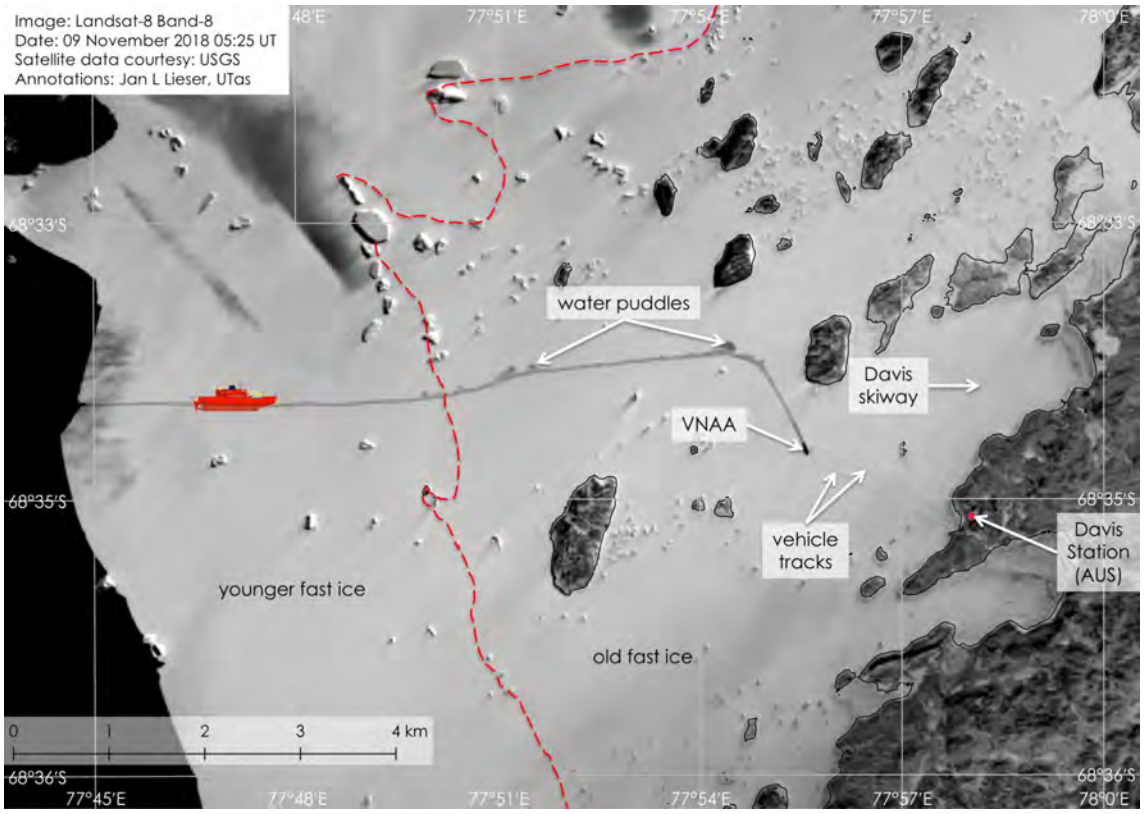

Figure 1: *Landsat-8 panchromatic data (Band 8) acquired 09/11/2018 at 05:25 UT and provided by USGS.*

The boundary between old fast ice near shore and younger fast ice further out is marked by a dashed red line.

The track of RSV *Aurora Australis* breaking through the fast ice is clearly visible. Some water puddles on top of the sea ice have been created by the ship while backing and ramming. Near the station, vehicle tracks and the Davis sea-ice skiway can also be seen.

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Sea Ice Report #46.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/11/2018

Mawson Station

Figure 1 shows a very high-resolution (15 m horizontal) panchromatic scene of Mawson Station and the fast ice offshore.

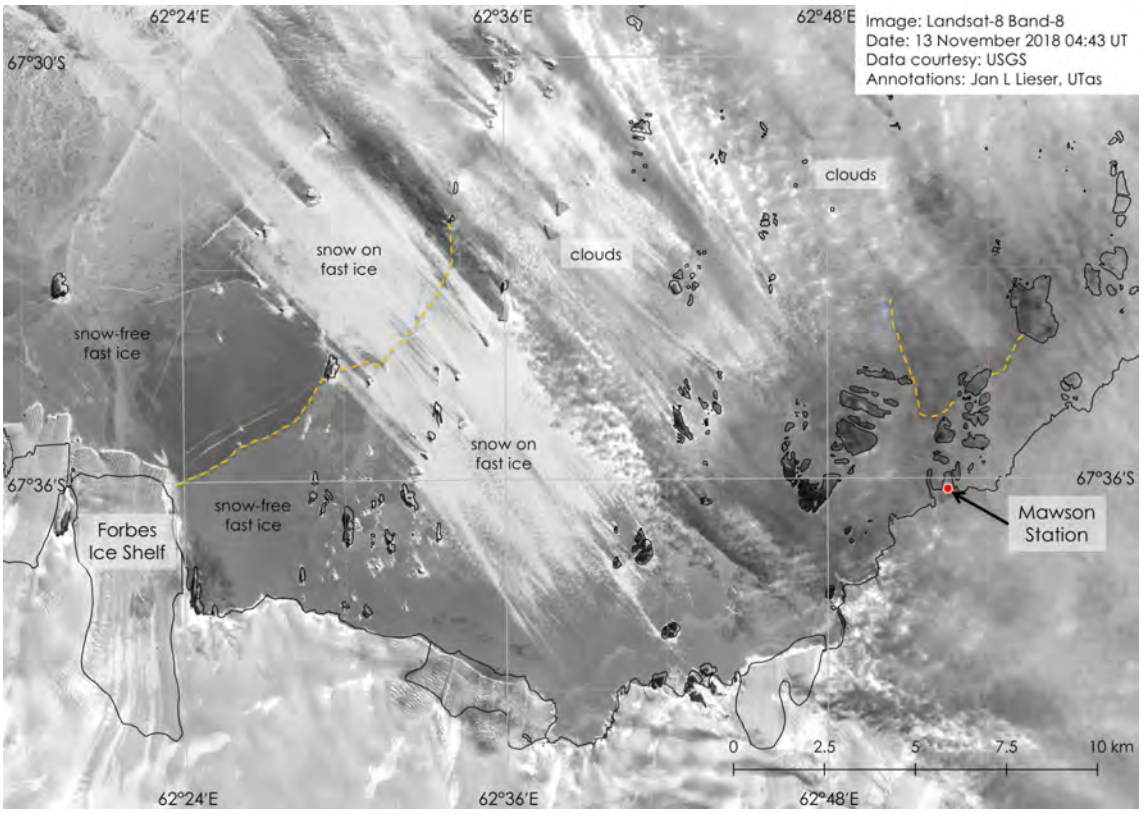

Figure 1: *Landsat-8 panchromatic data (Band 8) acquired 13/11/2018 at 04:43 UT and provided by USGS.*

The boundary between two different types of fast ice is marked by a dashed orange line. The difference in appearance may be a result of different fast-ice thickness, where the darker ocean shimmers through thinner parts of fast ice. Lack of a protective snow cover can also affect the surface condition.

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Figure 2 shows a high-resolution (30 m horizontal) visible composite scene of the wider region of Figure 1 (red-white frame in Figure 2).

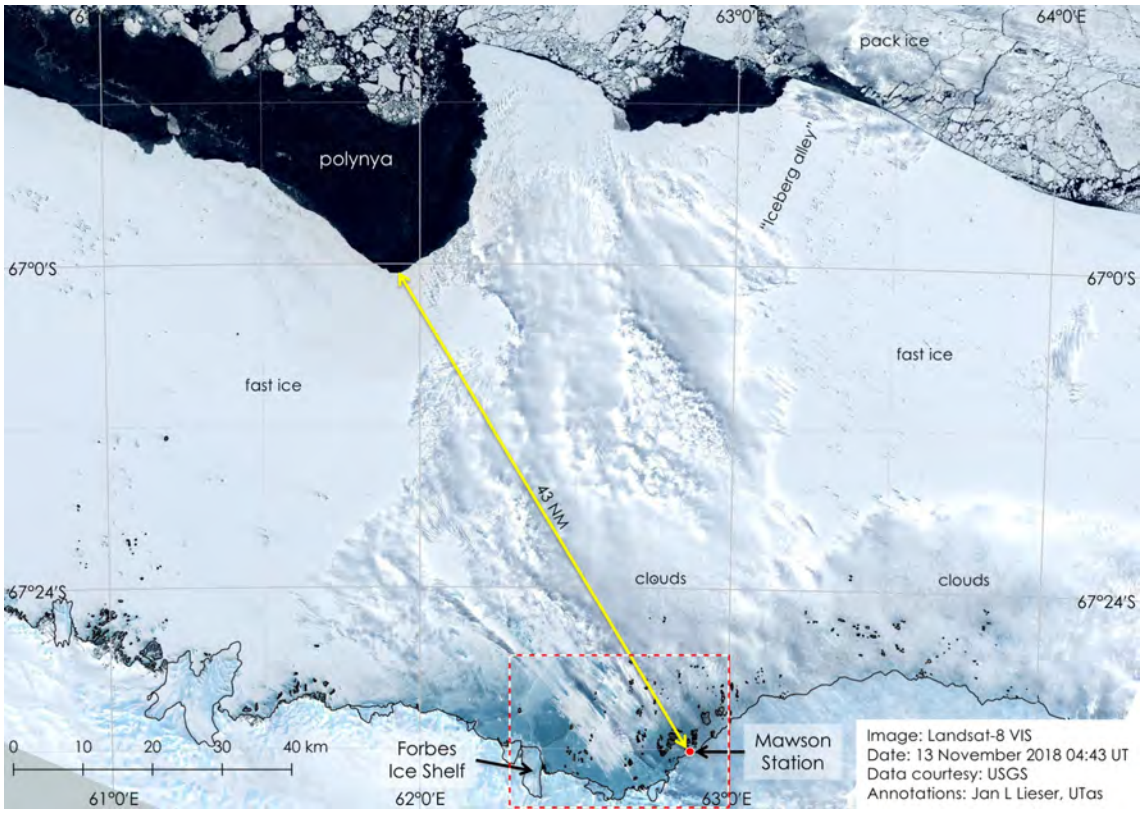

Figure 2: *Landsat-8 visible data composite acquired 13/11/2018 at 04:43 UT and provided by USGS.*

The above mentioned differences in fast-ice surface conditions are noticeable again, but here visibly more blue in the thinner parts of the fast ice.

The shortest distance to the fast-ice edge of the polynya northwest of Mawson Station is roughly 43 nautical miles.

Sea Ice Report #46.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/11/2018

Cooperation Sea

Figure 1 shows a sea-ice concentration chart of the wider region around Cooperation Sea. The green line marks the November median sea-ice extent and the yellow line marks the December median sea-ice extent.

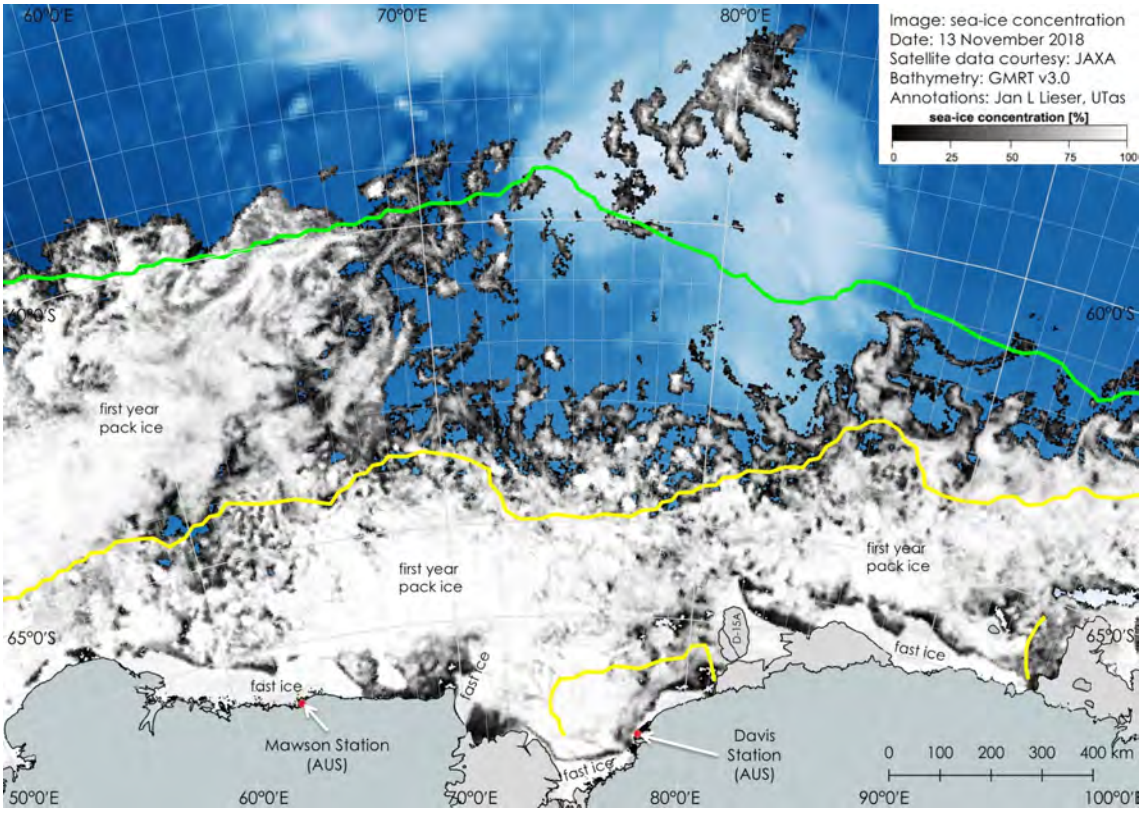

Figure 1: *Sea-ice concentration data acquired 13/11/2018 and provided by ICDC, Universität Hamburg.*

East of 70° E, the marginal ice zone has already reached the northern boundary of the December median sea-ice extent in mid-November, even though some patches of (decaying) pack ice are still far north of the November median extent close to 80° E.

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Sea Ice Report #46.5/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
15/11/2018

Casey Station

Figure 1 shows a high-resolution SAR scene of Casey Station and the last fast ice offshore.

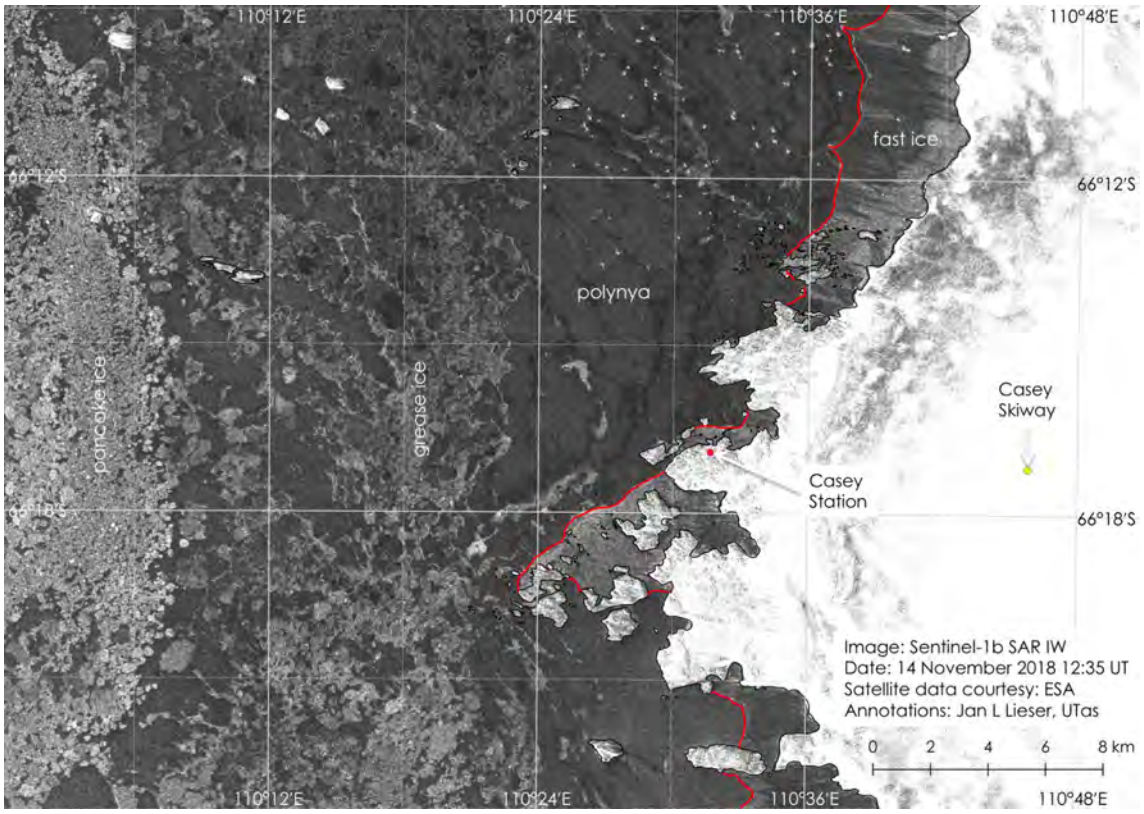

Figure 1: *Sentinel-1b SAR IW acquired 14/11/2018 at 12:35 UT and provided by PolarView.*

Off Casey Station, only very little fast ice remains nearshore in sheltered areas. The polynya is filled with grease ice and decaying pancake ice.

North of the station, the northern edge of the marginal ice zone is already approaching the December median sea-ice extent (similar to the situation north of Davis Station, see Sea Ice Report #46.4/2018) and is approximately 120 nautical miles away.

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Sea Ice Report #47.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
19/11/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea. Additionally, the sea-ice edge on 14/11/2018, 15/11/2018, 16/11/2018 and 17/11/2018 is marked as a red, orange, yellow and green line, respectively.

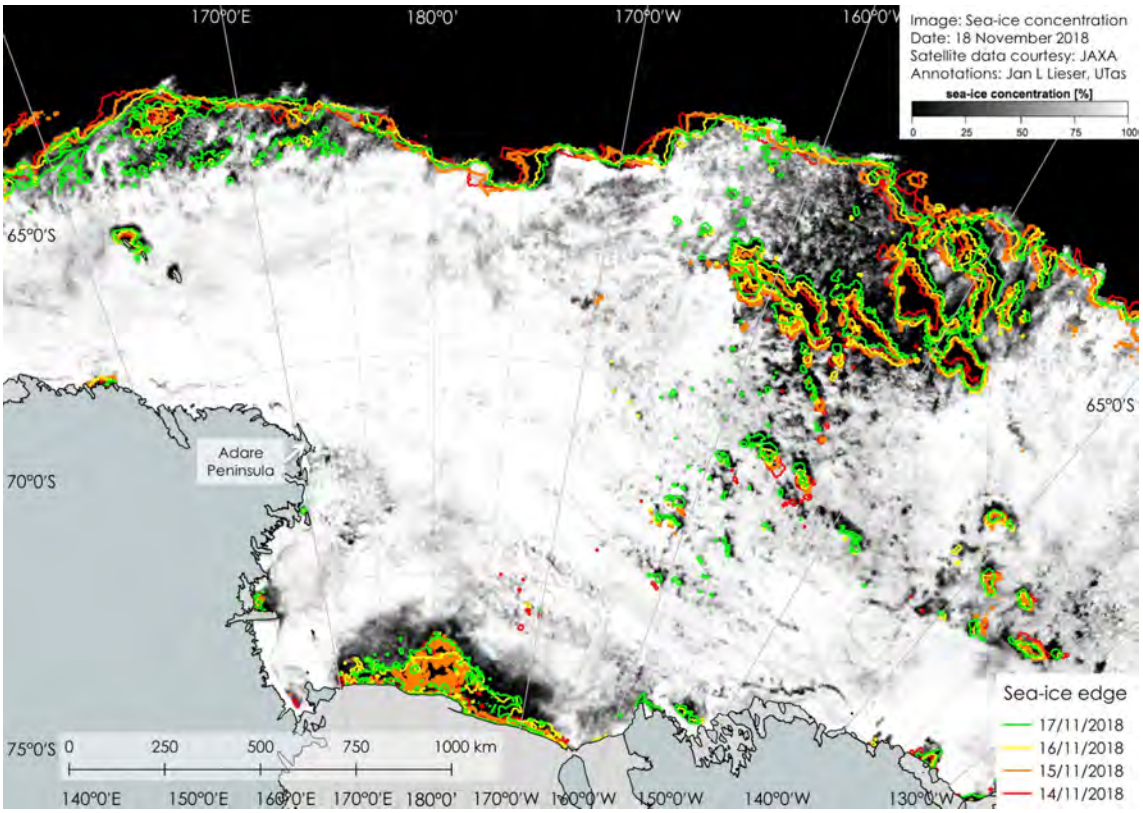

Figure 1: *Sea-ice concentration data acquired 18/11/2018 and provided by ICDC, Universität Hamburg.*

Generally, the sea-ice edge is moving eastward, but the sea ice of the marginal ice zone is breaking up and sea-ice concentration is reducing with the spring melt. Off the Ross Ice Shelf, the polynya is growing.
Between 175° E and 165° W, the passing of local weather systems pushed the sea-ice edge slightly southward and compacted it.
Between 160° W and 150° W, low-to-medium sea-ice concentration can be found as far south at 70° S.

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Sea Ice Report #47.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
19/11/2018

Davis Sea

Figure 1 shows a sea-ice concentration chart of the Davis Sea. Additionally, the sea-ice edge on 16/11/2018 and 17/11/2018 is marked as a green and cyan line, respectively. The cruise track of RSV *Aurora Australis* since she departed Davis Station is given by the orange line (up until 19/11/2018 05:30 UT).

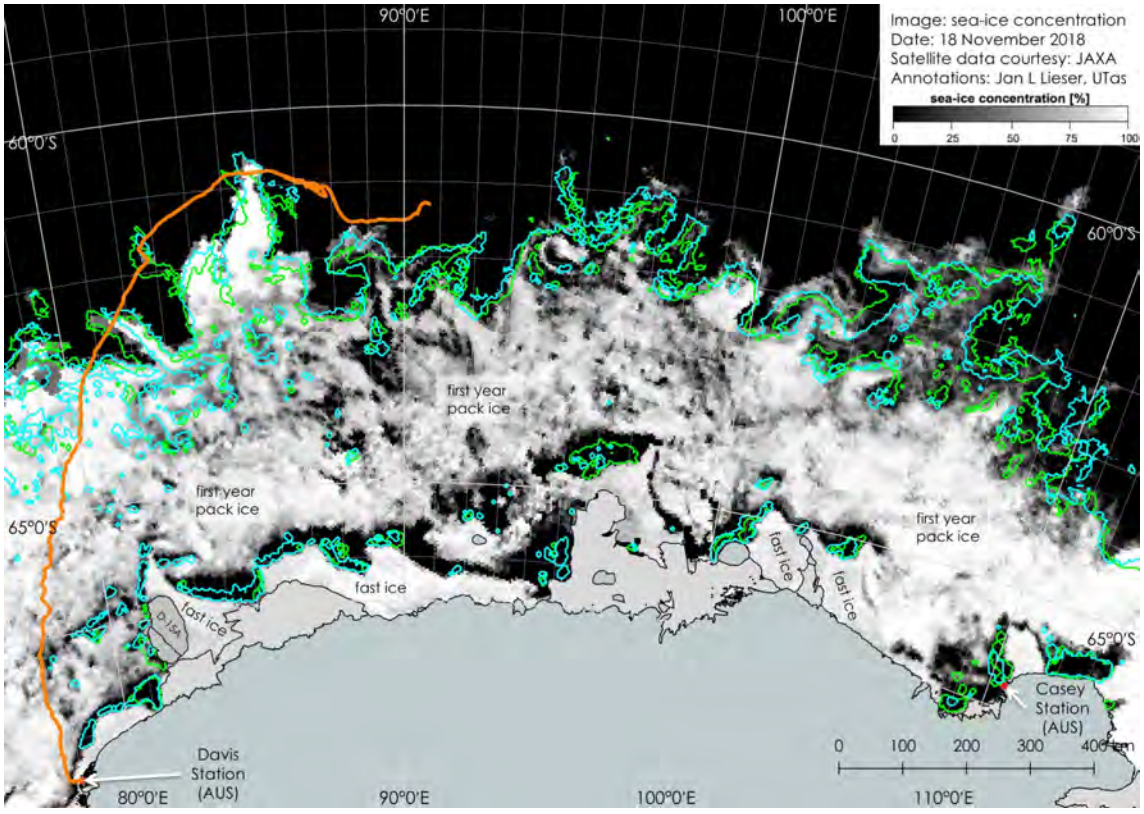

Figure 1: *Sea-ice concentration data acquired 18/11/2018 and provided by ICDC, Universität Hamburg.*

Generally, the sea-ice edge is moving eastward and retreating and the sea ice of the general pack in the region is breaking up and sea-ice concentration is reducing with the spring melt.

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Sea Ice Report #47.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
20/11/2018

Davis Station

Figure 1 shows a high-resolution SAR scene of Davis Station and the last fast ice offshore.

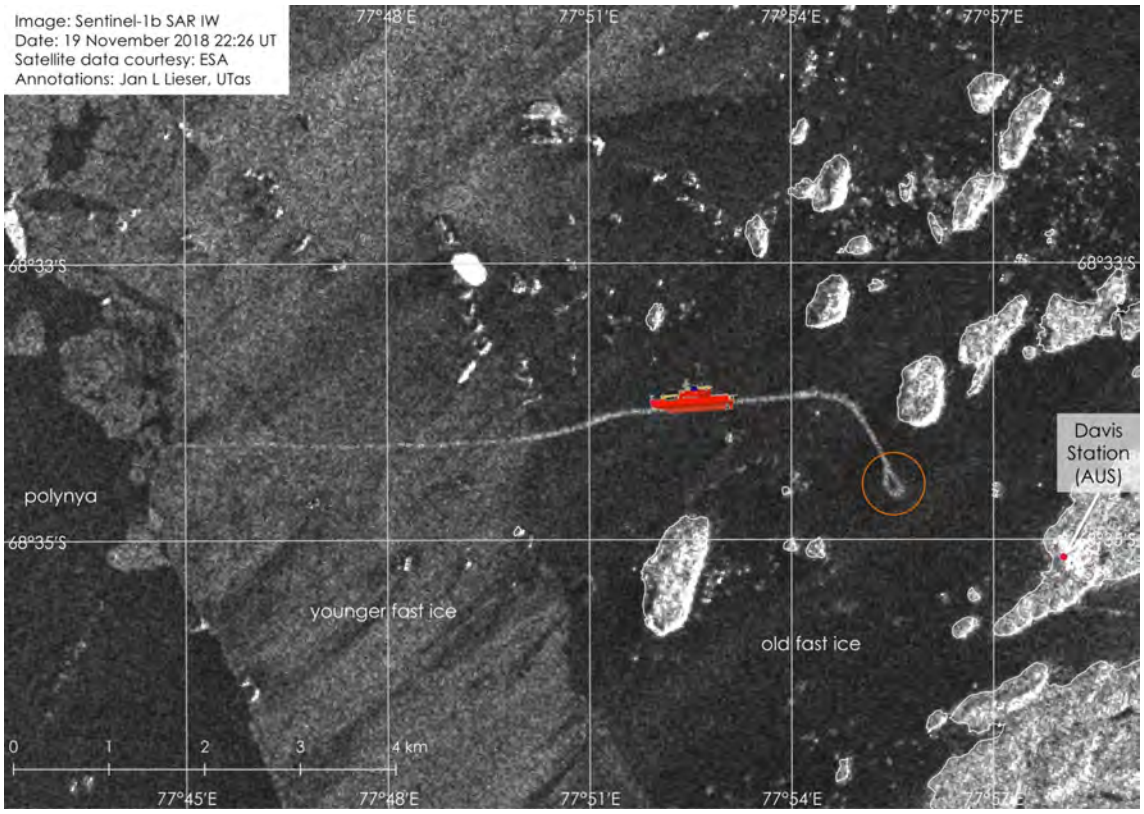

Figure 1: *Sentinel-1b SAR IW acquired 19/11/2018 at 22:26 UT and provided by PolarView.*

After the completion of the resupply operations, RSV *Aurora Australis* performed a tear-drop turn (marked by an orange circle) and returned to the open water of the polynya. Since then, the fast ice edge has started retreating towards the coast and large floes of ex-fast ice can be seen breaking off.

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Davis Sea

Figure 2 shows a high-resolution sea-ice concentration data of Davis Station. The cruise track of RSV *Aurora Australis* is given by the orange line (up until 20/11/2018 06:00 UT).

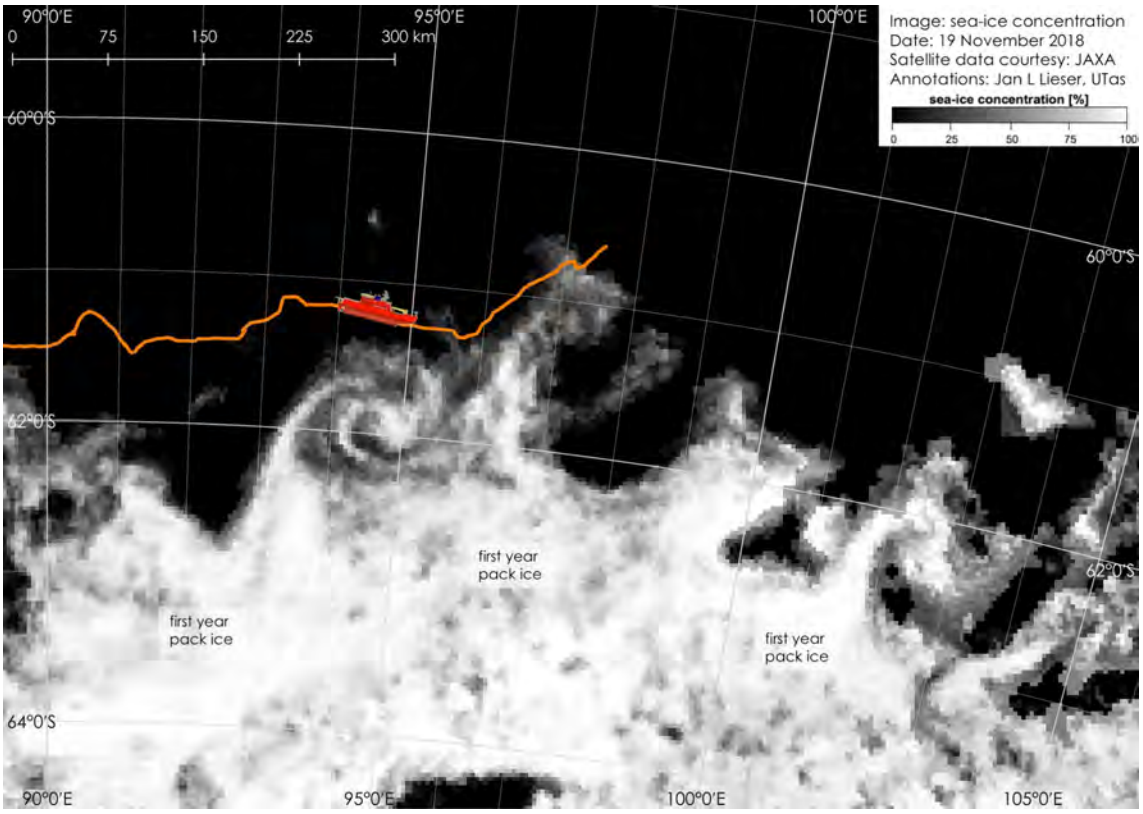

Figure 2: *Sea-ice concentration data acquired 19/11/2018 and provided by ICDC, Universität Hamburg.*

The high resolution sea-ice concentration data reveal an eddy structure of higher and lower concentration sea ice centred roughly at 95° E and 62° S. Such a formation is typical where velocity differences occur at the interface between different fluids (here: ice-covered water and ice-free water). This phenomenon is called Kelvin-Helmholtz instability and is observed regularly at the sea-ice edge around Antarctica at the moment and is also occurring in the atmosphere where it can be visible in cloud formations.

D'Urville Sea

Figure 3 shows a visible scene of D'Urville Sea and the fast ice offshore. The fast-ice edge from 16/11/2018 is marked by the dashed red line. The recent cruise track of OPV *l'Astrolabe* is given by the white line (up until 20/11/2018 00:00 UT).

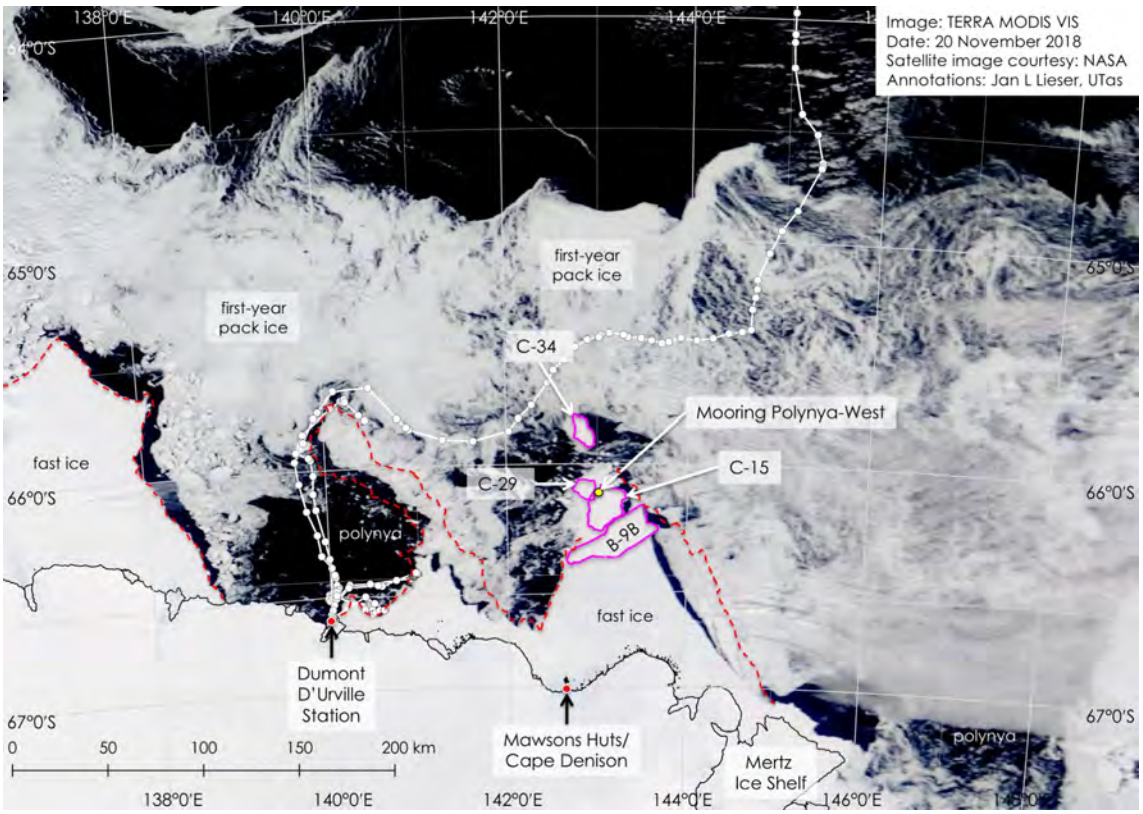

Figure 3: *TERRA MODIS VIS data acquired 20/11/2018 and provided by NASA.*

Between Dumont D'Urville Station and Cape Denison, the fast ice is breaking up rapidly, as well as around the group of large tabular icebergs north of Cape Denison.

Sea Ice Report #47.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
22/11/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea. Additionally, the sea-ice edge on 18/11/2018, 19/11/2018 and 20/11/2018 is marked as an orange, yellow and green line, respectively, and the November median sea-ice extent as a red line.

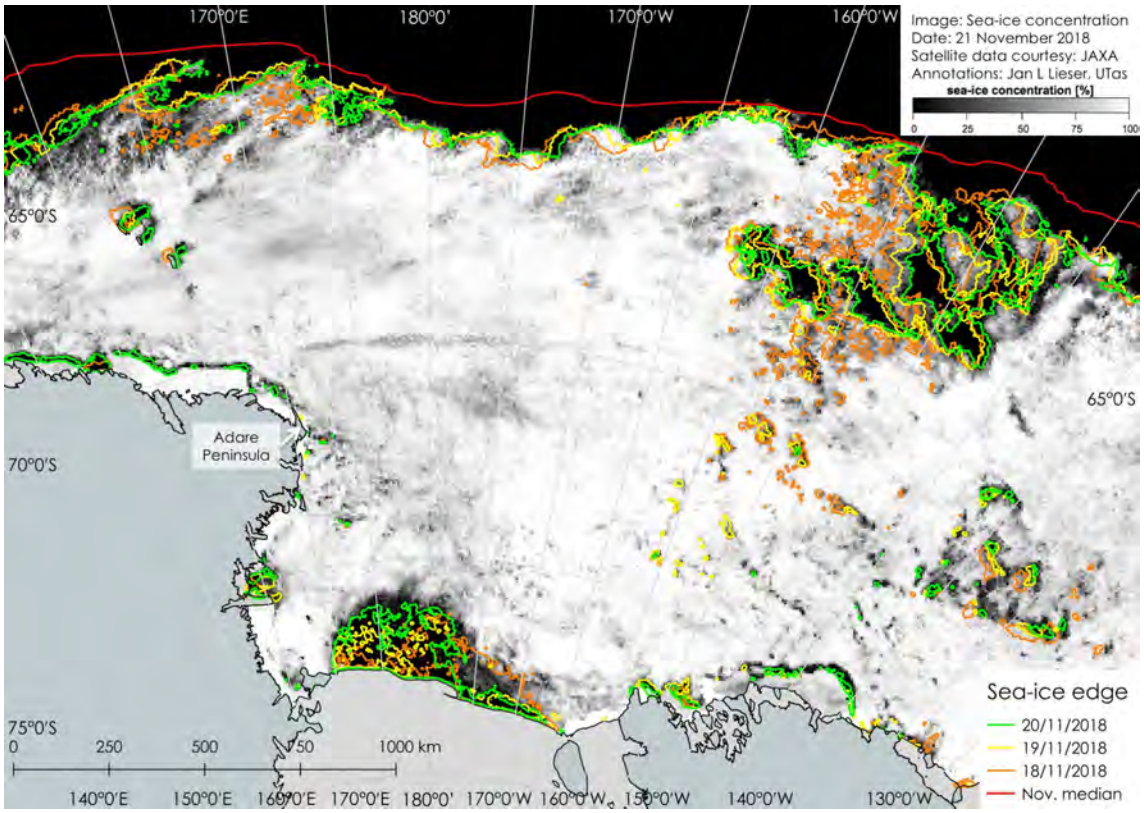

Figure 1: *Sea-ice concentration data acquired 21/11/2018 and provided by PolarView.*

North of 70° S, the pack ice of the Ross Sea is drifting northeastward, but between 175° E and 165° W the northern sea-ice edge is not expanding further northward where the sea ice is melting. Between 160° W and 150° W, the northeastern sea-ice drift has pushed low-to-medium sea-ice concentration northward and increased sea-ice concentration locally. Off the Ross Ice Shelf, the polynya continues to grow.

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Sea Ice Report #48.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
26/11/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea. Additionally, the sea-ice edge on 21/11/2018, 22/11/2018, 23/11/2018 and 24/11/2018 is marked as an orange, yellow, green and cyan line, respectively. Additionally, the total coverage of SAR scene shown in Figures 3 and 4 are indicated by red-white frames.

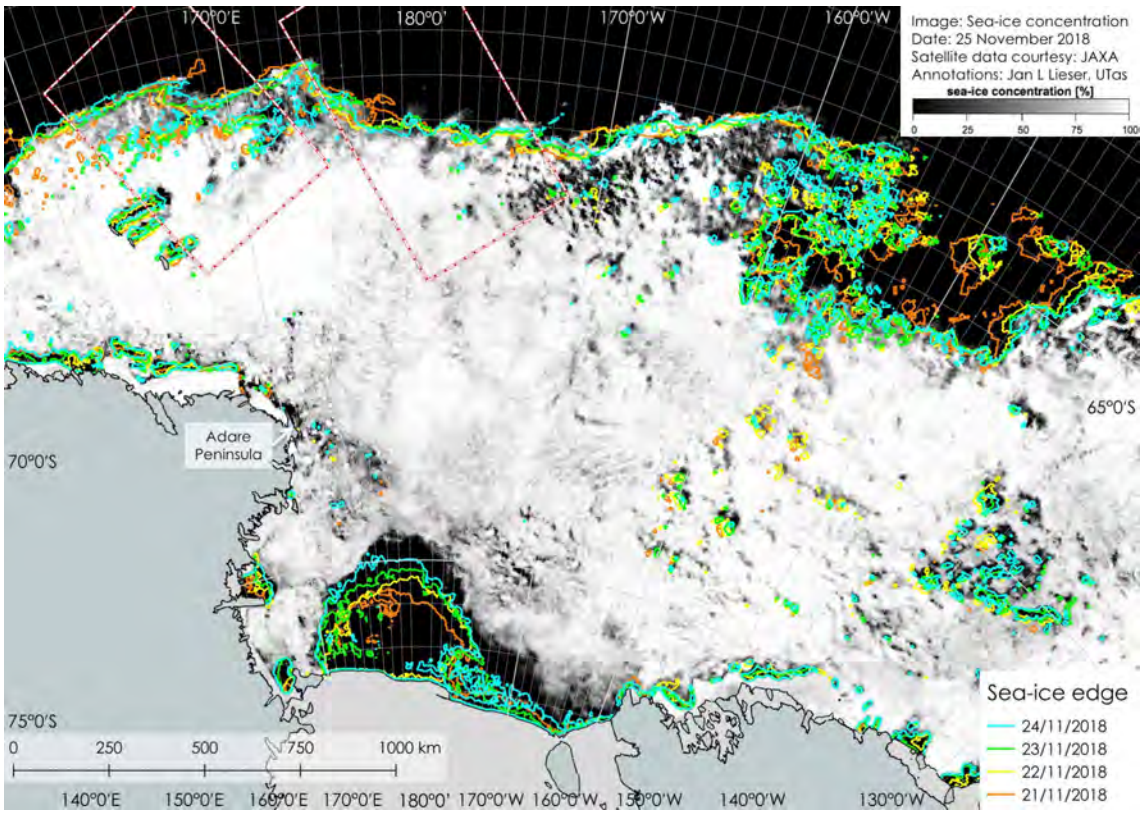

Figure 1: *Sea-ice concentration data acquired 25/11/2018 and provided by ICDC, Universität Hamburg.*

North of 70° S and west of 160° W, the pack ice of the Ross Sea is drifting northeastward, but between 175° E and 165° W the northern sea-ice edge is not expanding significantly further northward where the sea ice is melting. However, east of 160° W, the northern pack ice is drifting westward during the last two days. Off the Ross Ice Shelf, the polynya continues to grow.

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East and west of 150° W, the northern sea-ice edge has moved south and low-to-medium sea-ice concentration is further expanding north 67° S (see Figure 2).

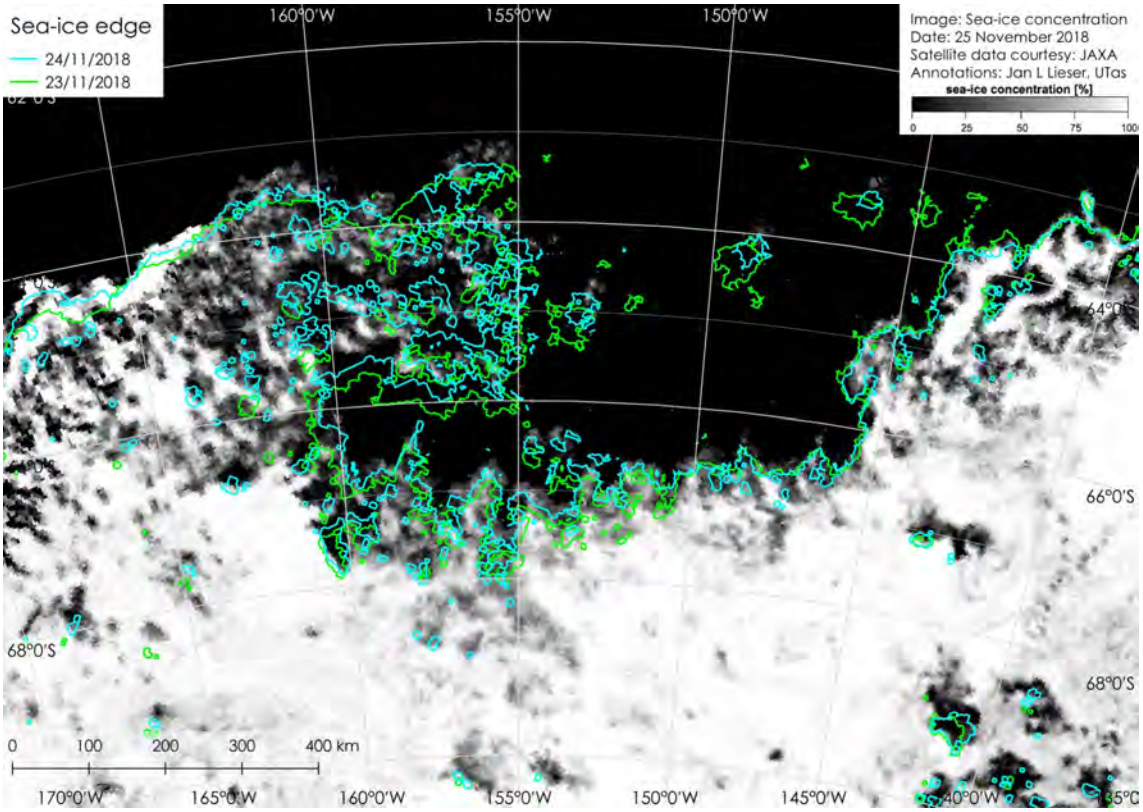

Figure 2: *Close-up of the eastern edge of the frame shown in Figure 1.*

Figures 3 and 4 show two Synthetic Aperture RADAR (SAR) scenes, which were acquired the same day as the sea-ice concentration data (Figure 1), and show additionally the sea-ice edge as a red line based on sea-ice concentration data from 25/11/2018 (Figure 1). (Punch holes along 180° in the SAR data of Figure 3 are a processing artefact.)

The two SAR scene are provided to highlight the difficulties of capturing very low concentrations in the sea-ice concentration charts based on passive microwave data as they are provided in Figures 1 and 2. Strips and patches of decaying sea ice can extend further north than the sea-ice edge based on passive microwave data suggests. Also, icebergs are not detectable with passive microwave data, therefore the ice limit will be significantly further north than the sea-ice edge based on passive microwave data.

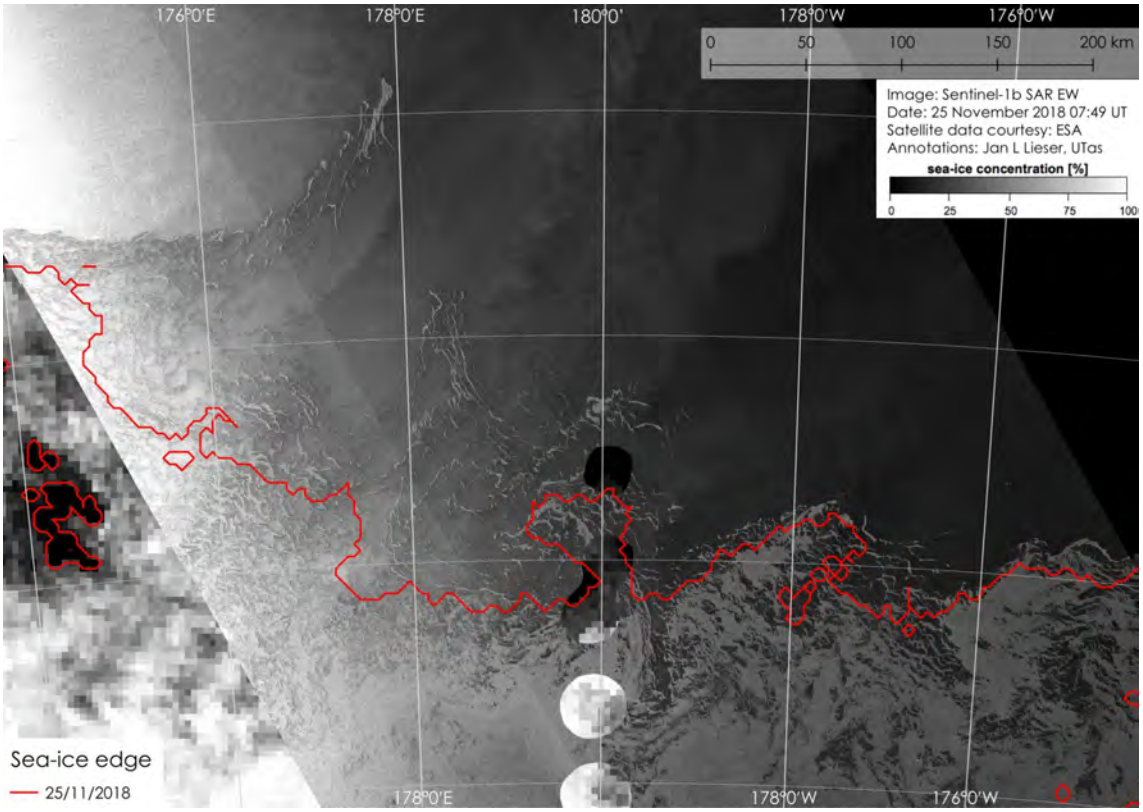

Figure 3: *Sentinel-1b SAR EW scene acquired on 25/11/2018 at 07:49 UT and provided by PolarView; complemented by sea-ice concentration data (Figure 1).*

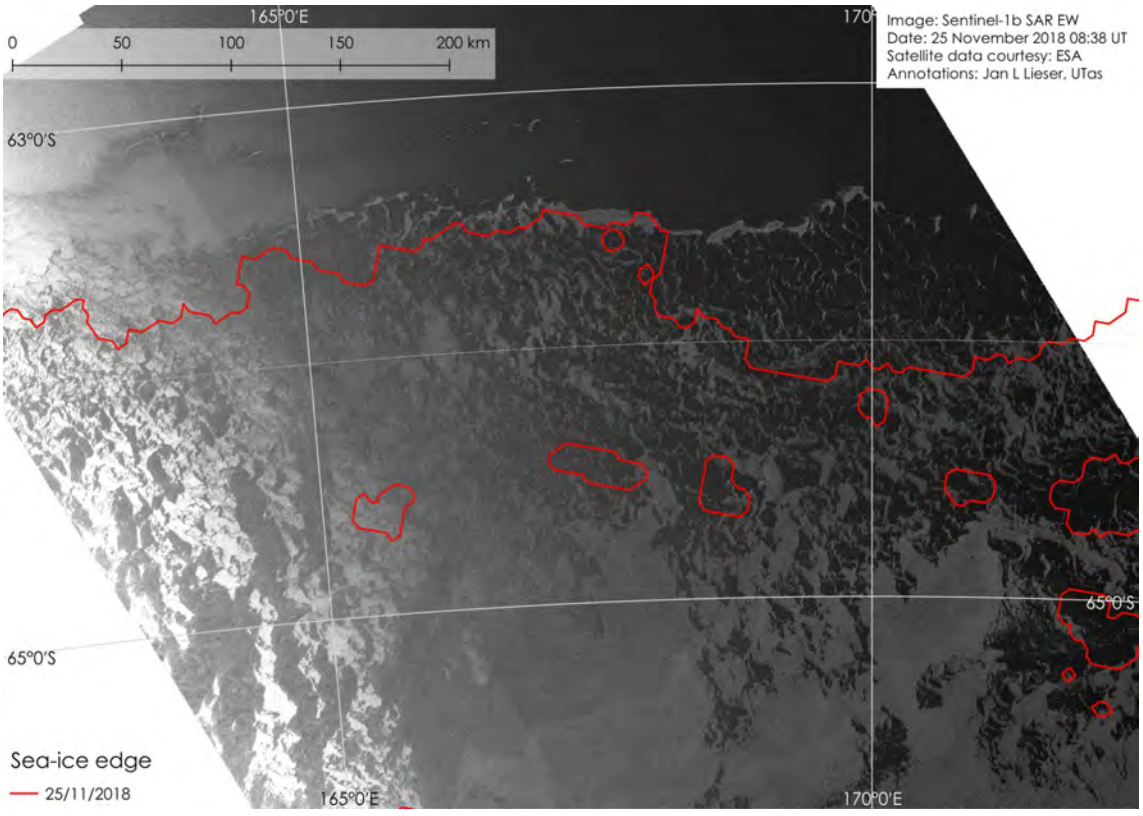

Figure 4: *Sentinel-1b SAR EW scene acquired on 25/11/2018 at 08:38 UT and provided by PolarView.*

Sea Ice Report #48.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
27/11/2018

Casey Station

Figure 1 shows a high-resolution SAR scene of Casey Station and surrounds.

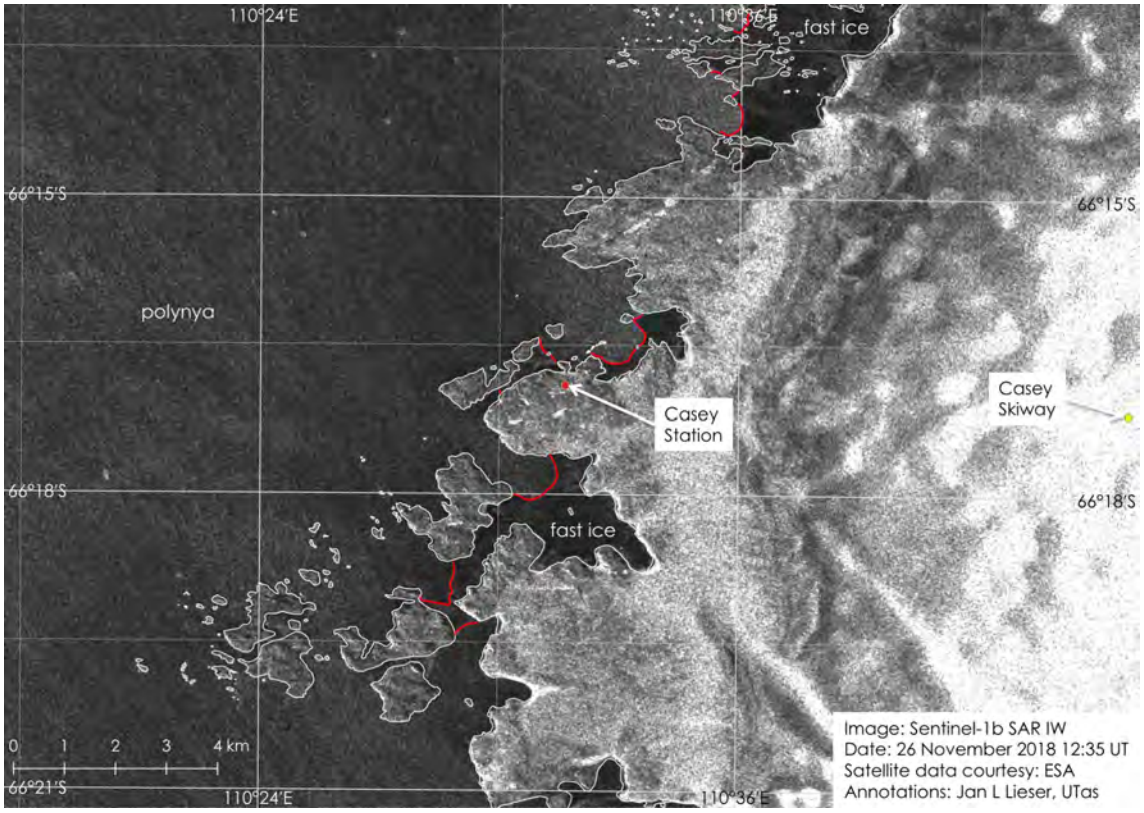

Figure 1: *Sentinel-1b SAR IW scene acquired on 26/11/2018 at 12:35 UT and provided by PolarView.*

Shore-fast sea ice remains only inside sheltered bays at the coast. A few icebergs can be identified offshore.

Sabrina Coast

Figure 2 shows a visible scene of the coast between Law Dome and the Dalton Iceberg Tongue and ice conditions offshore.

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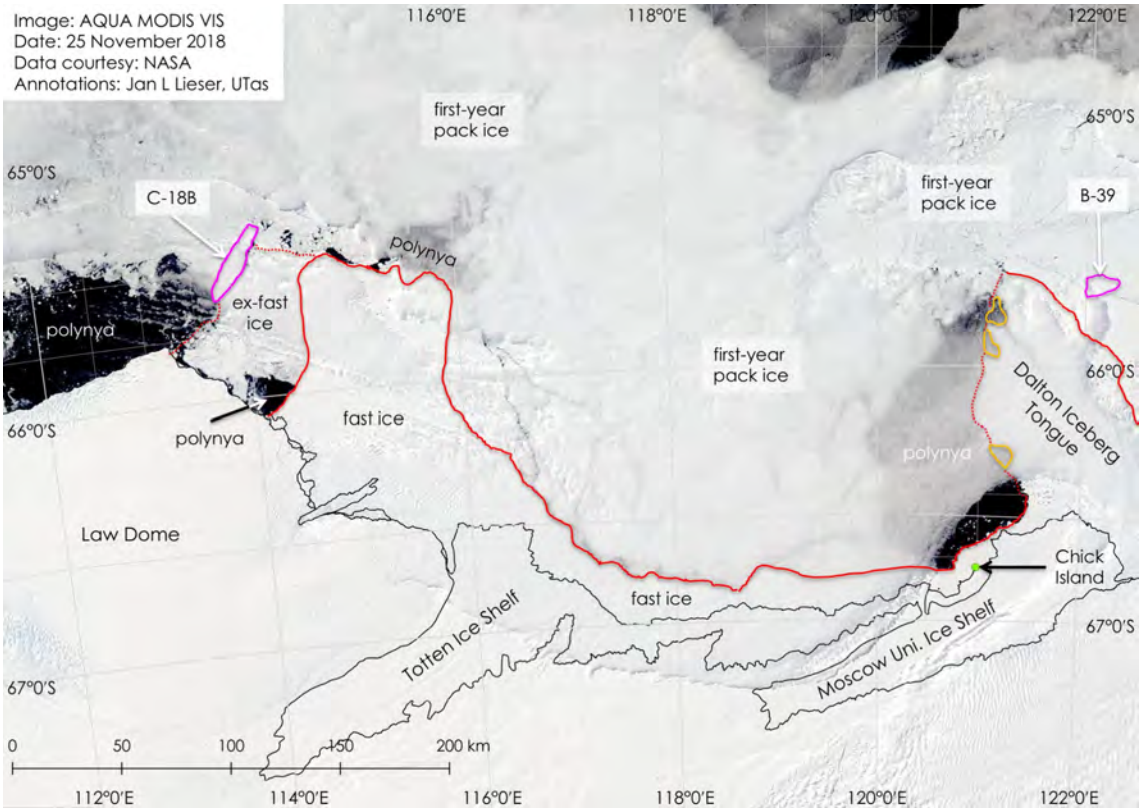

Figure 2: *AQUA MODIS VIS scene acquired 25/11/2018 and provided by NASA.*

North of the Totten Ice Shelf and the Moscow University Ice Shelf, fast ice distribution is typical for the time of year. However, east of iceberg C-18B, a large area of former fast ice has broken up. The ex-fast ice floes of this area are trapped behind rows of icebergs (indicated by dotted red lines) but escape through small gaps between the bergs as soon as the floes are broken up small enough. The last time this area was free of any sea ice was March 2016, which was only much later in the season.

Also at the western edge of the Dalton Iceberg Tongue (where the iceberg edge is marked by dotted red lines again), pockets of fast ice between icebergs have been melting (indicated by orange outlines). While it is not too unusual for the southernmost of these pockets to be ice free, the northern two are somewhat atypical.

Off Chick Island, the fast ice edge, which is roughly 9.5 km offshore, has been fairly stable during the last weeks.

D'Urville Sea

Figure 3 shows a visible scene of the coast between Dumont D'Urville Station and the Mertz Ice Shelf and ice conditions offshore. The fast-ice edge and the positions of large tabular icebergs on 20/11/2018 are marked by a dashed red and pink lines, respectively.

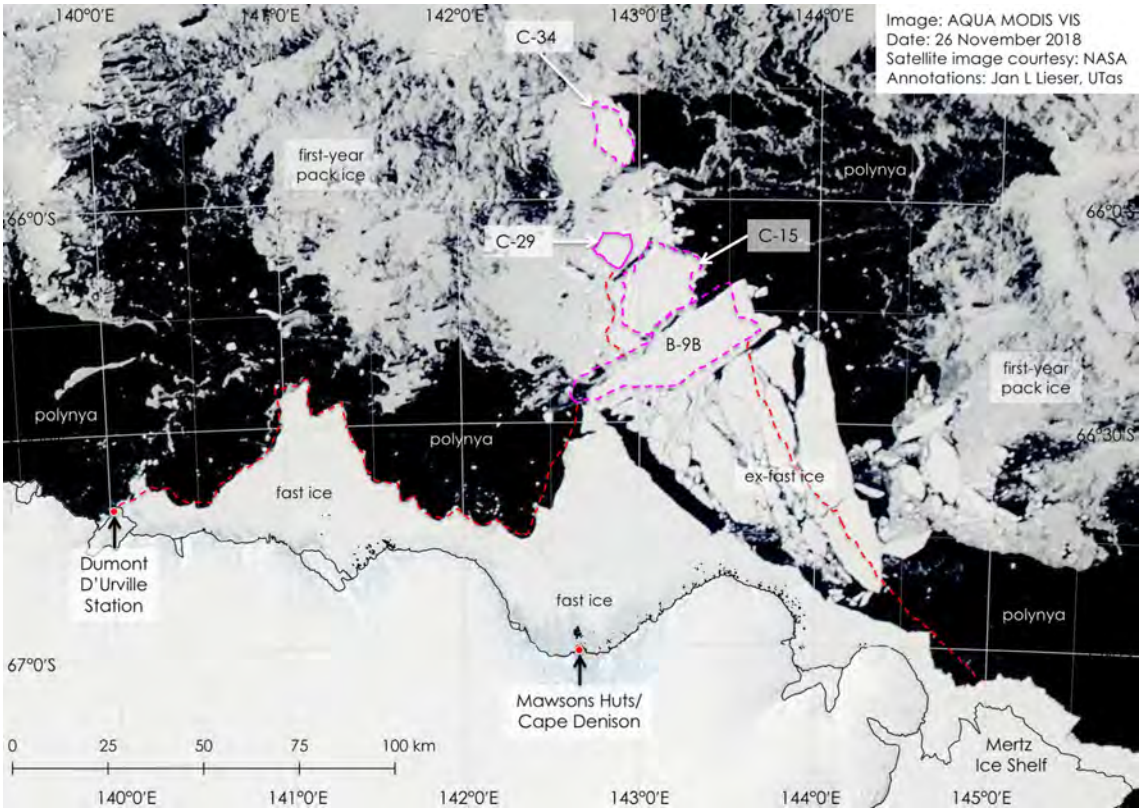

Figure 3: *AQUA MODIS VIS scene acquired 26/11/2018 and provided by NASA.*

Off Cape Denison, fast ice is breaking up in large sheets. This has freed the large icebergs north of Cape Denison. While C-34 remains grounded at its southern end (and was rotating roughly 12 degrees clockwise since 20/11/2018), icebergs B-9B and C-15 are on the move again. Iceberg B-9B has drifted approximately 5 km eastward before being stopped again by two small grounded icebergs at its eastern end and iceberg C-15 has shifted roughly 2 km eastward. Iceberg C-29 remains unmoved.

Sea Ice Report #48.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
27/11/2018

Casey Station

Figure 1 shows a high-resolution SAR scene of Casey Station and south of it.

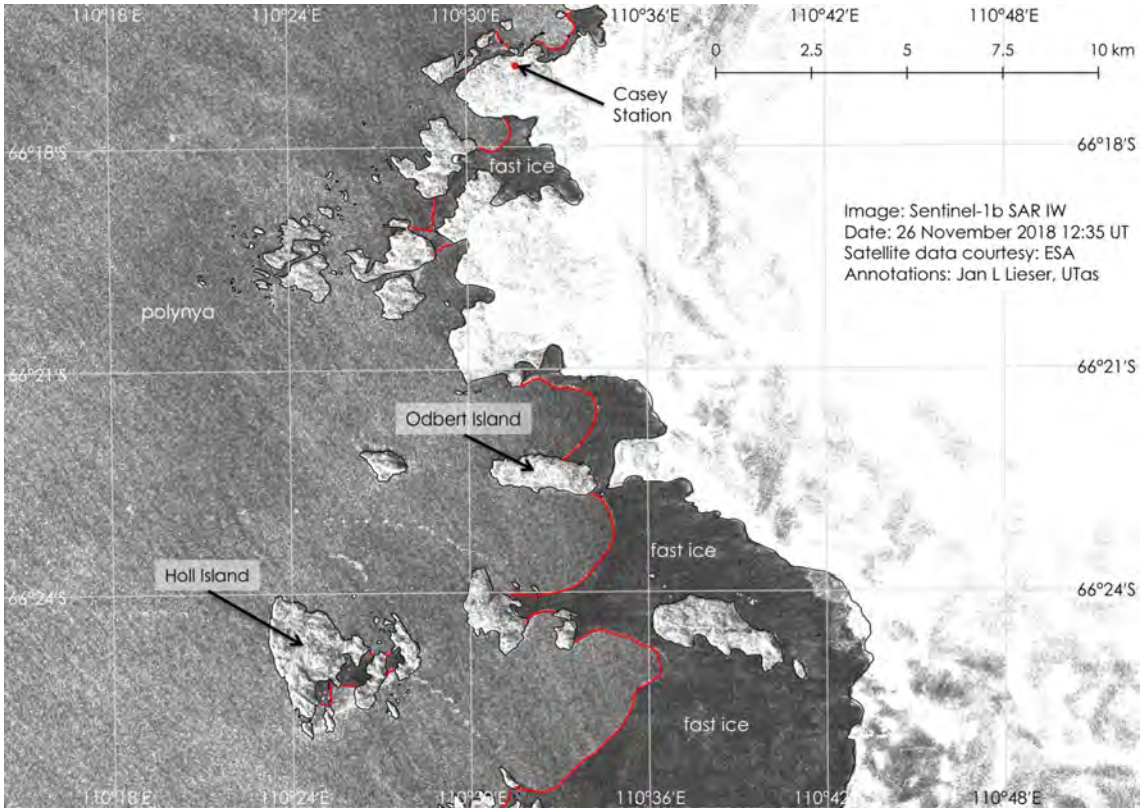

Figure 1: *Sentinel-1b SAR IW scene acquired on 26/11/2018 at 12:35 UT and provided by PolarView.*

Only shore-fast sea ice remains close to the coast. Northeast and southeast of Odbert Island, the fast-ice edge has an arched shape, which is typical for retreating ice that is still pinned between anchor points (here offshore islands).

Southeast of Holl Island, some fast ice remains still between the island and the islands southeast of it.

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Sea Ice Report #48.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
28/11/2018

Sabrina Coast

Figure 1 shows a SAR scene of the northern end of the Moscow University Ice Shelf. The fast ice edge on 25/11/2018 is given by the red line.

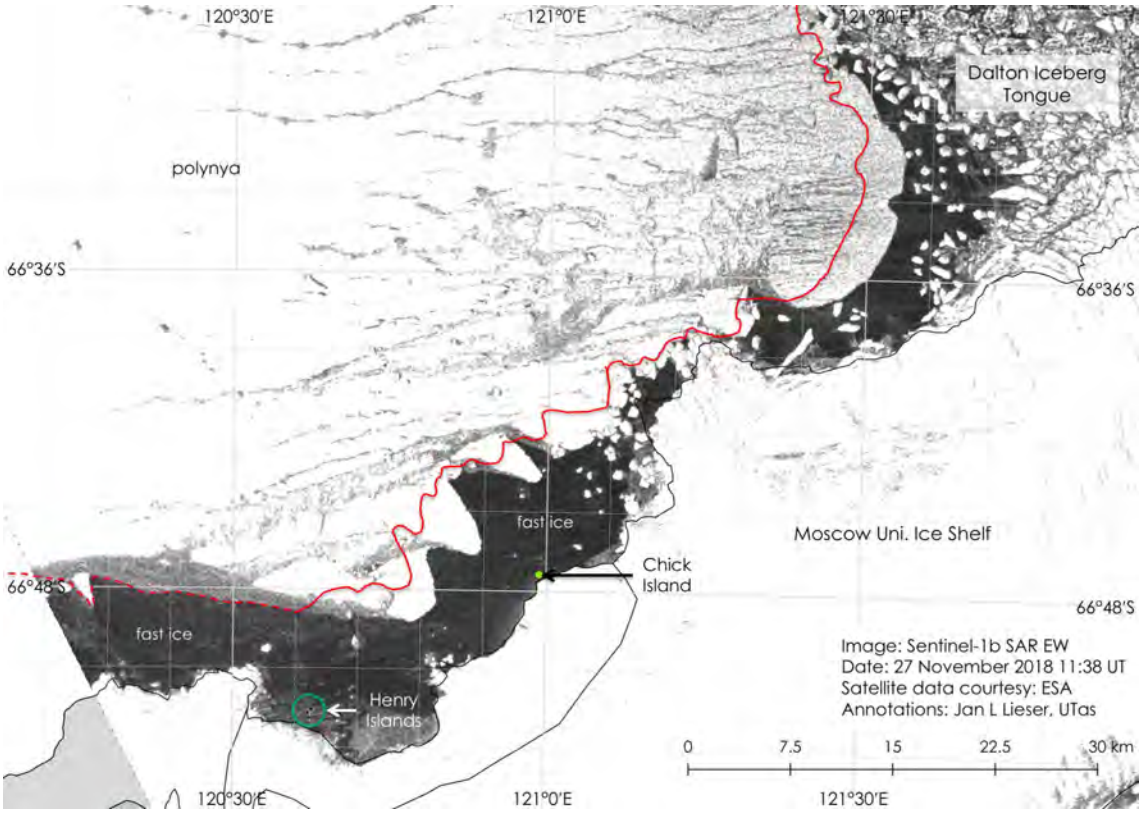

Figure 1: *Sentinel-1b SAR EW scene acquired on 27/11/2018 at 11:38 UT and provided by PolarView.*

Since 25/11/2018, the fast-ice edge has been retreating towards the coast. The position of a large low-pressure system northwest of Law Dome has brought strong winds along the coast, which aided the break-up of fast ice in the region. Sea ice of the 'Dalton polynya' has been pushed westward and some remaining streaks of brash ice can be seen drifting west in the polynya.

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Sea Ice Report #48.5/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
29/11/2018

Casey Station

Figure 1 shows a SAR scene of Casey Station and south of it. The fast-ice edge on 26/11/2018 is indicated by the dashed red lines.

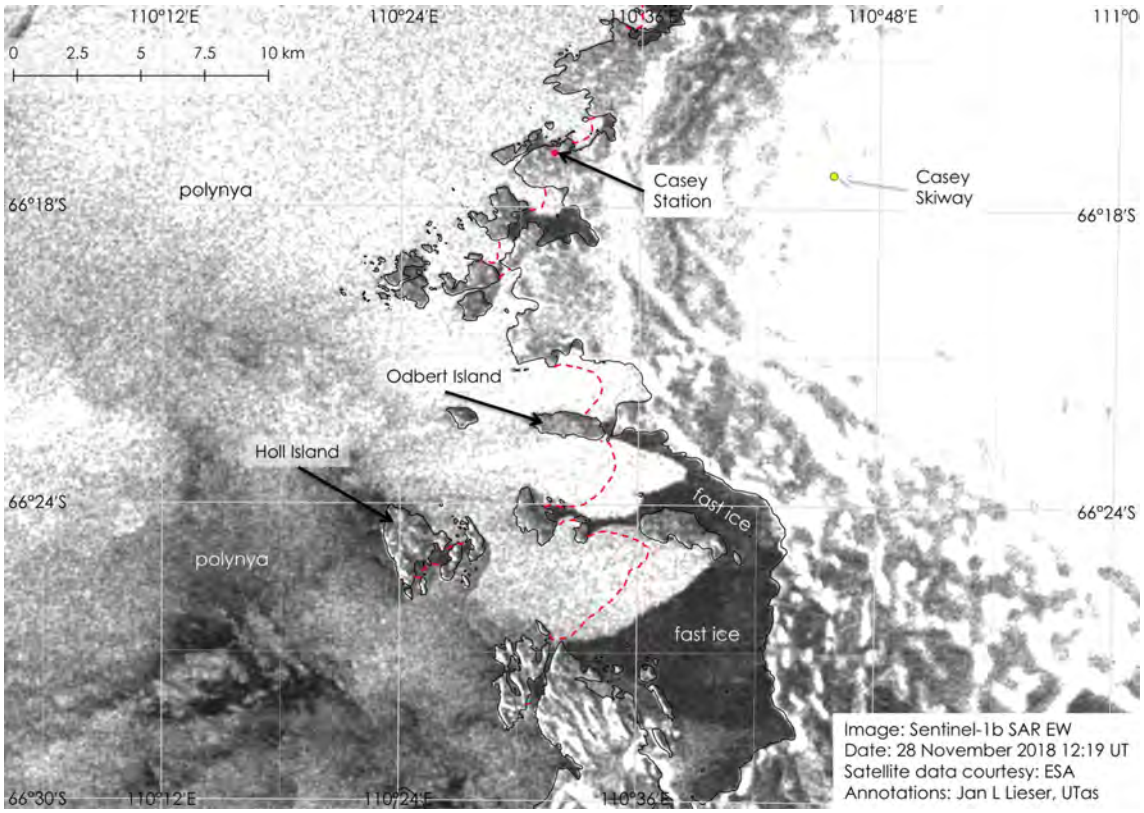

Figure 1: *Sentinel-1b SAR EW scene acquired on 28/11/2018 at 12:19 UT and provided by PolarView.*

During the past two days, shore-fast sea ice has broken off along the coast. East of Odbert Island, only a small fast-ice connection remains between the island and the continental coast.

North of Casey Station, fast ice is also breaking off the coast, where the western flank of Law Dome is now free of ice north of Honkala Island (and its surrounding islands) up to 66° 5' S and 110° 45' E (region not included in Figure 1).

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Sea Ice Report #48.6/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
29/11/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea. Additionally, the sea-ice edge on 25/11/2018, 26/11/2018 and 27/11/2018 is marked as an orange, yellow and green line, respectively.

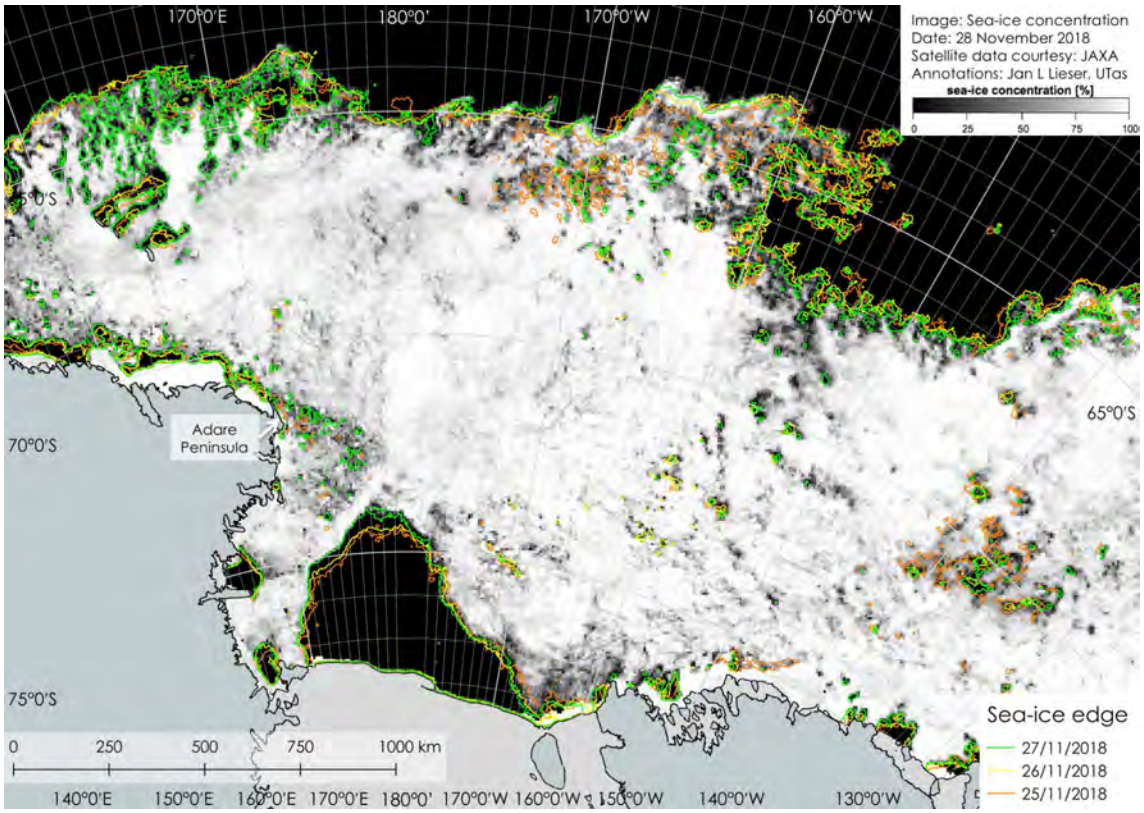

Figure 1: *Sea-ice concentration data acquired 28/11/2018 and provided by PolarView.*

North of 70° S, the pack ice of the Ross Sea continues its northeastward drift, but the northern sea-ice edge is not expanding further northward where the sea ice is melting. North of the Balleny Islands (west of 165° E), the pack ice is opening up and larger areas of very low sea-ice concentration are growing west of the islands. Also, west of 160° W and north of 67° S, a large region of very low sea-ice concentration continues to expand.
Off the Ross Ice Shelf, the polynya continues to grow slowly.

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Sea Ice Report #49.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
03/12/2018

Casey Station

Figure 1 shows a high-resolution SAR scene of Casey Station and surrounds.

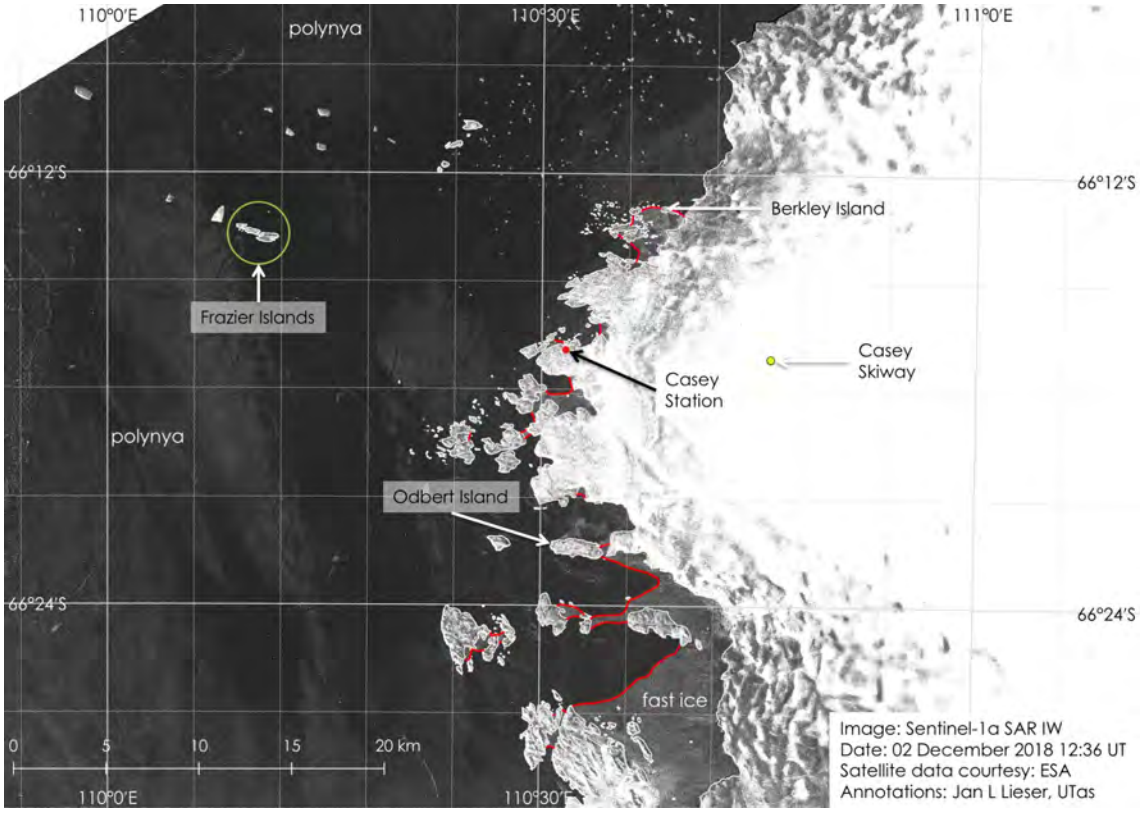

Figure 1: *Sentinel-1a SAR IW scene acquired on 02/12/2018 at 12:36 UT and provided by PolarView.*

During the weekend, the distribution of shore-fast sea ice has not changed significantly. East of Odbert Island, only a small fast-ice connection remains between the island and the continental coast.

North of Casey Station, the western flank of Law Dome is free of fast ice north of Berkley Island up to 66° 5' S and 110° 45' E.

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Sabrina Coast

Figure 2 shows a sea-ice concentration chart for Sabrina Coast and surrounding regions. Additionally, the sea-ice edge for 29/11/2018, 30/11/2018 and 01/12/2018 is provided as a red, orange and yellow line, respectively.

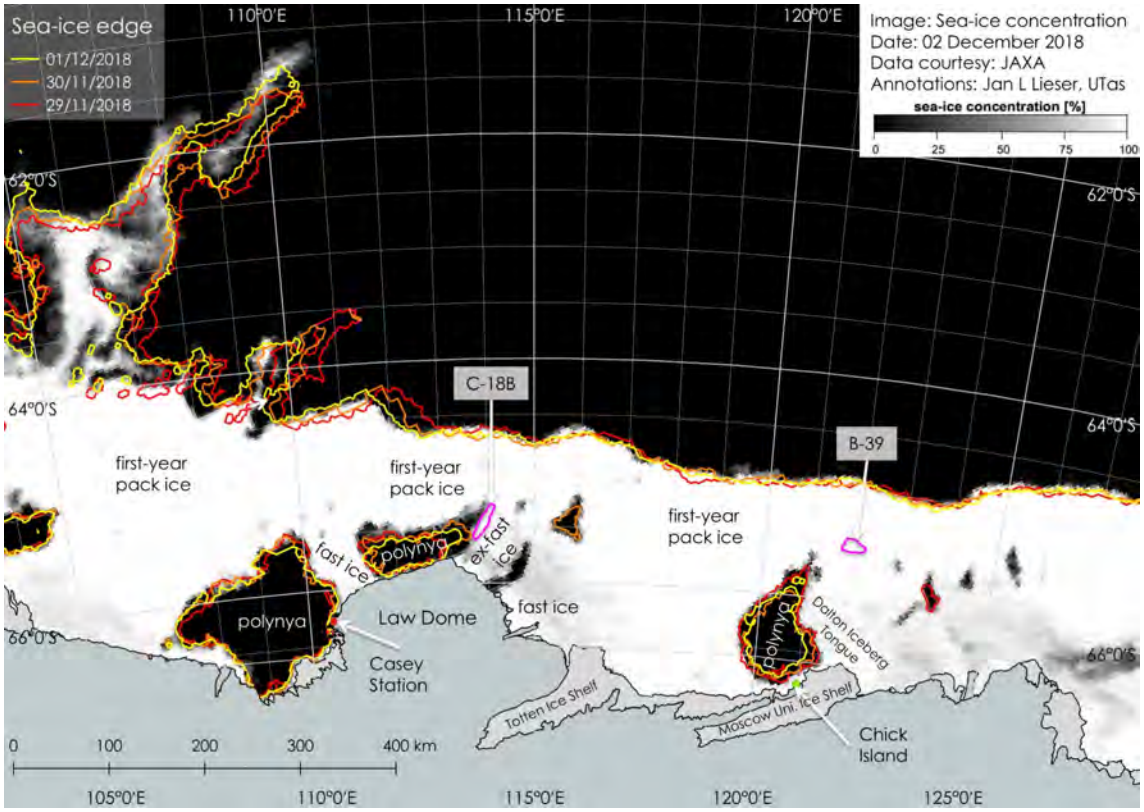

Figure 2: *Sea-ice concentration acquired on 02/12/2018 and provided by ICDC, Universität Hamburg.*

Recent weather conditions have created a consolidated sea-ice edge east of 110° E. While the polynyas of the region have roughly maintained shape and size, the pack ice separating these open water areas from the open ocean has been compacted and is of very high concentration. Along 110° E, the pack ice spans approximately 70 nautical miles in north-south direction.

Figure 3 shows a visible scene of the so-called 'Dalton Polynya'. The boundaries of the polynya on 26/11/2018 (see Sea Ice Report #48.2 for comparison) are indicated by dashed lines, where yellow shows the pack-ice edge, orange the edge of fast ice between the bergs of the Dalton Iceberg Tongue and red the fast-ice edge off the Moscow University Ice Shelf.

North of 66° S, clouds are obscuring the ice surface slightly. The pack-ice edge has been pushed westward. Fast ice between the bergs of the iceberg tongue is retreating further eastward and close to the coast fast ice continues to break up where streaks of ex-fast ice can be seen drifting northward in the polynya.

Off Chick Island, the fast-ice edge is shifting closer to shore.

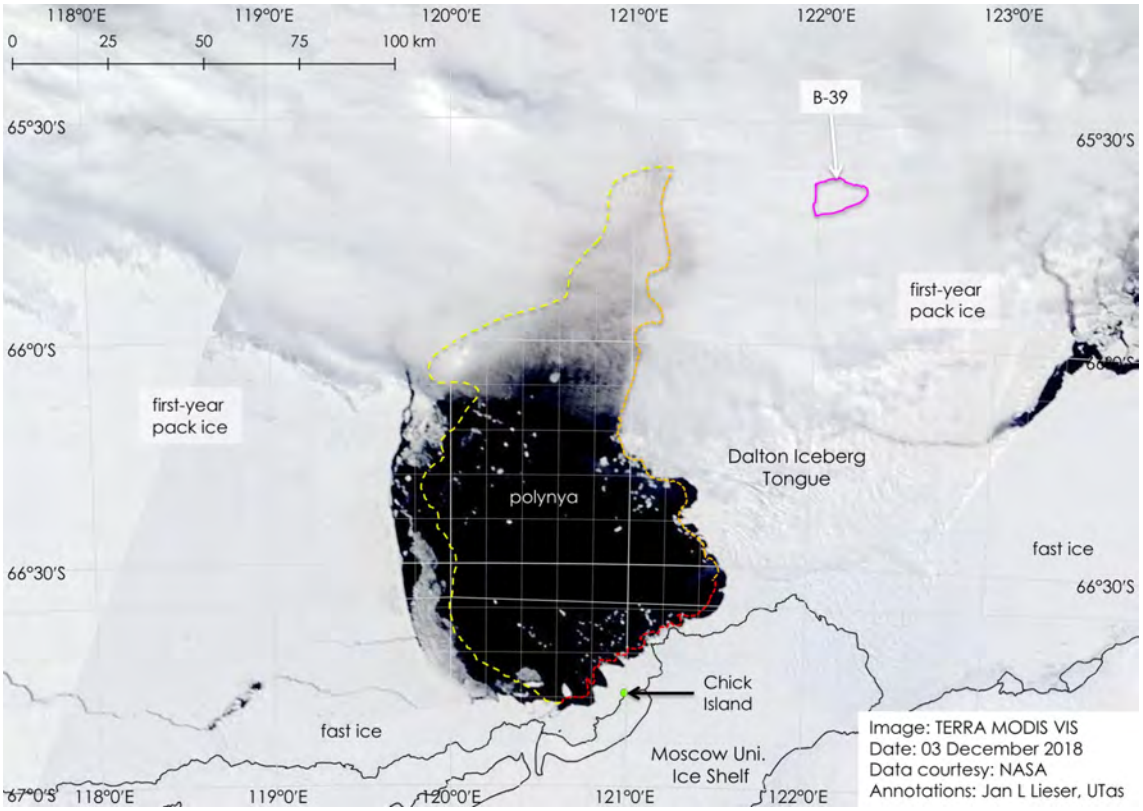

Figure 3: *TERRA MODIS VIS scene acquired on 03/12/2018 and provided by NASA.*

Sea Ice Report #49.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/12/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea with the sea-ice edge on 29/11/2018, 30/11/2018, 01/12/2018 and 02/12/2018 marked as a red, orange, yellow and green line, respectively.

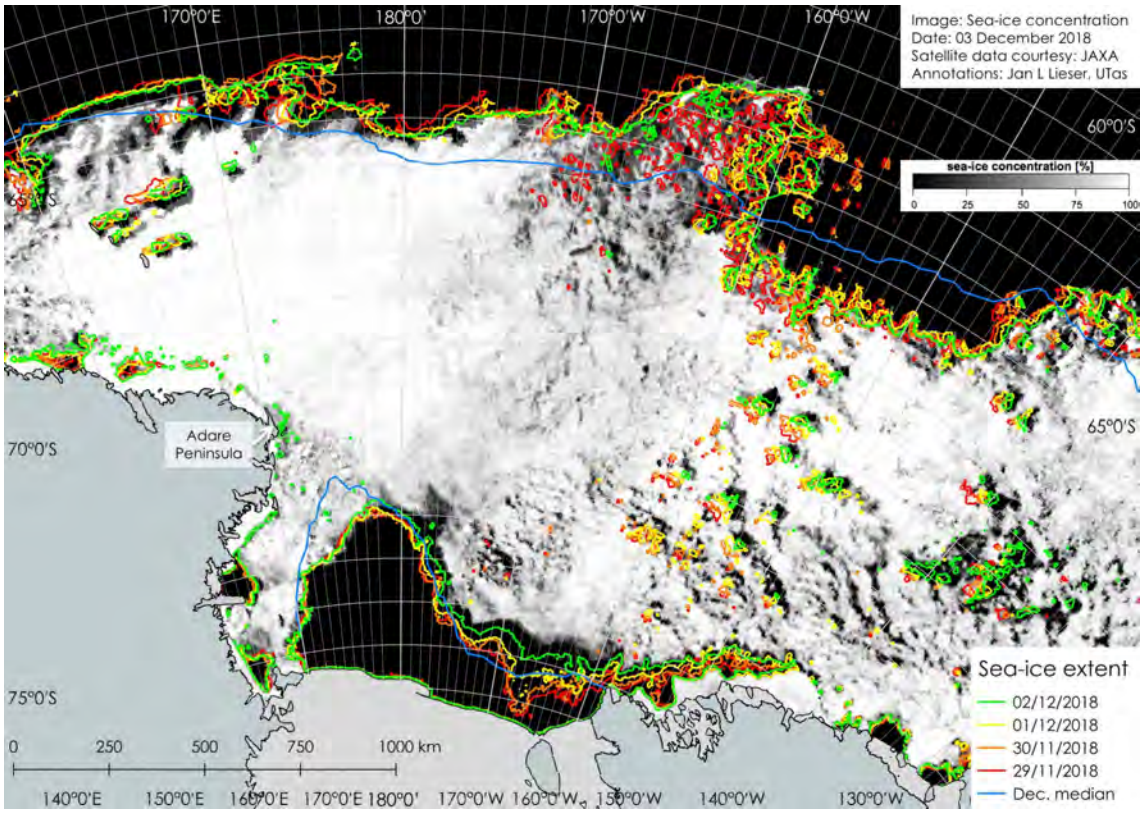

Figure 1: *Sea-ice concentration data acquired 03/12/2018 and provided by PolarView. The December median sea-ice extent is given by the blue line.*

North of 70° S, the pack ice of the Ross Sea continues its northeastward drift generally. The sea-ice edge appears slightly more fuzzy now and east of 170° W, the pack ice shows more advanced signs of melt. In a sector between 160° W and 150° W, patches of open water show a consistent drift towards the northeast. South and east of the Balleny Islands (west of 165° E), the pack ice remains closed and of high concentration.
Off the Ross Ice Shelf, the polynya continues to expand further at its eastern side.

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Sea Ice Report #49.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/12/2018

Casey Station

Figure 1 shows a SAR scene of the sea-ice zone north of Casey Station.

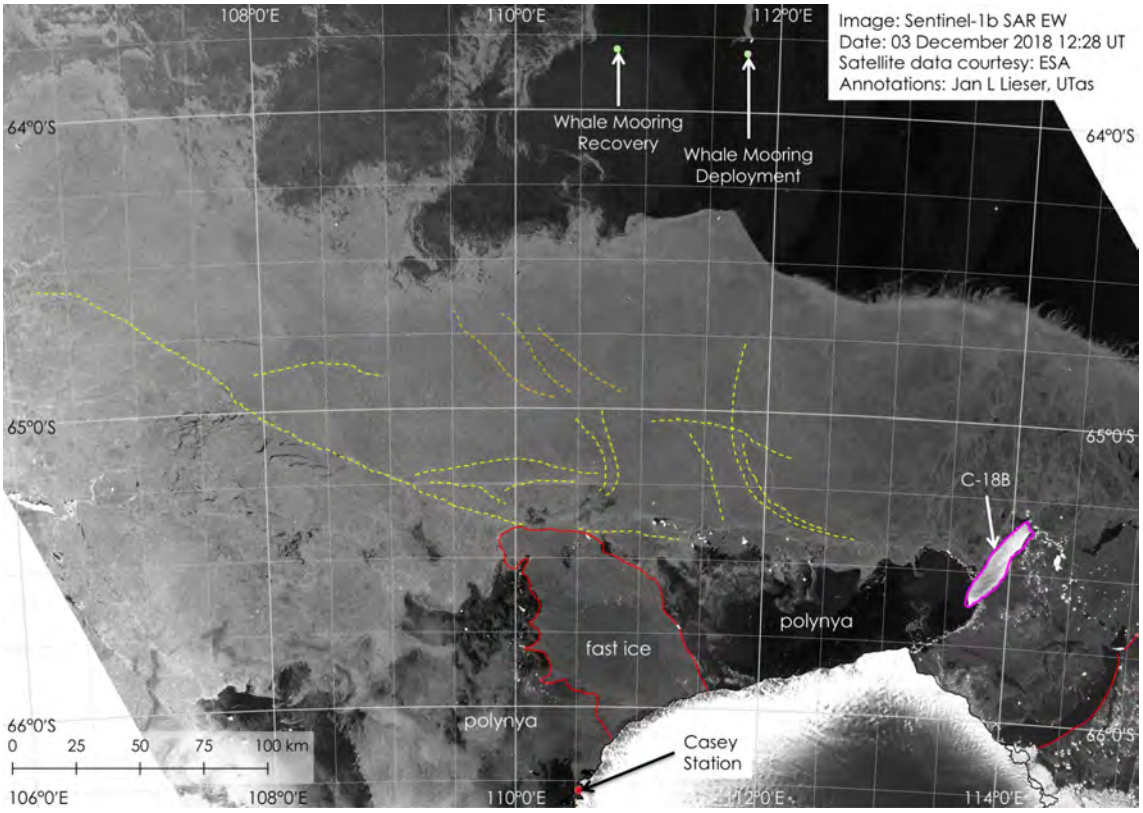

Figure 1: *Sentinel-1b SAR EW scene acquired on 03/12/2018 at 12:28 UT and provided by PolarView.*

North of the station, the open ocean is separated from the polynya off the station by approximately 72 nautical miles of high-concentration sea ice. The sea-ice zone has been consolidated by the passing of recent weather systems and is generally drifting westward with the surface ocean current.

Some of the ridge features of the compact pack ice have been marked by dashed lines (yellow larger features, orange smaller features). Fast ice has been marked by a red outline.

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Sabrina Coast

Figure 2 shows a SAR scene off Sabrina Coast.

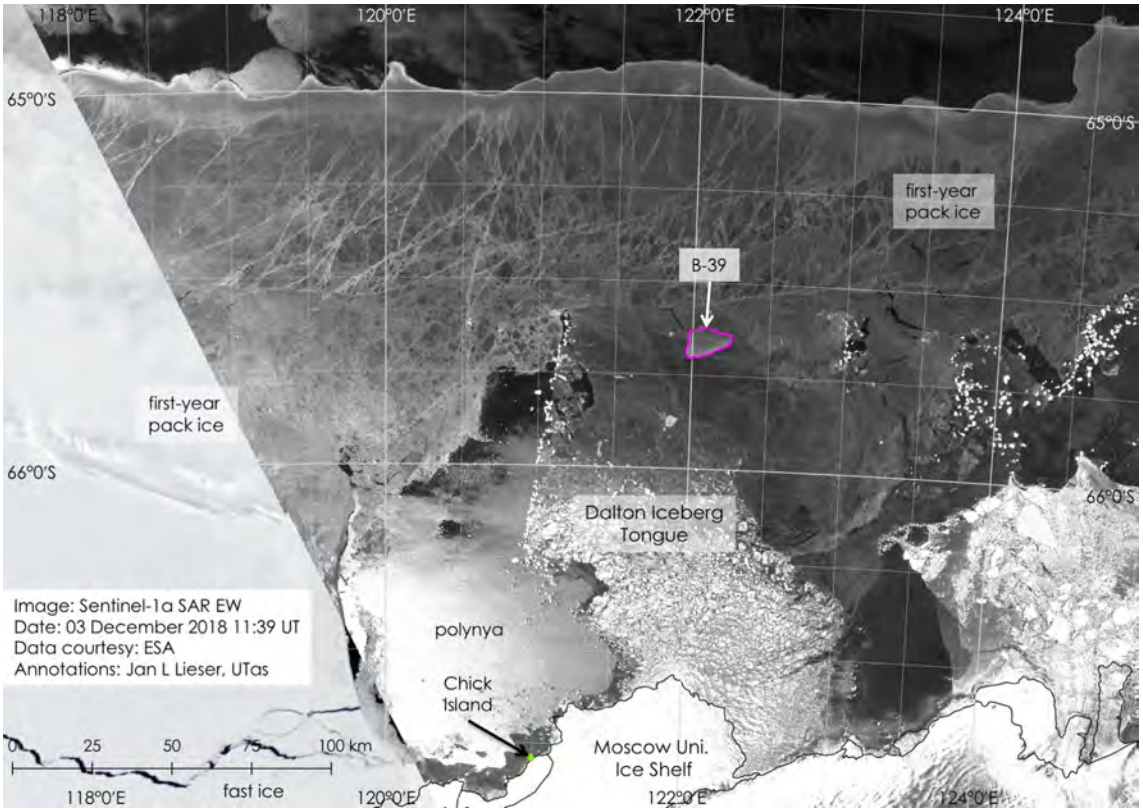

Figure 2: *Sentinel-1a SAR EW scene acquired on 03/12/2018 at 11:39 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired 03/12/2018 and provided by NASA.*

Along 65° S, the well defined sea-ice edge is clearly detectable and major deformation features are also showing up as zig-zagging white lines (high RADAR reflectivity) in the high-concentration of drifting pack ice north of the polynya west of the Dalton Iceberg Tongue.

Sea Ice Report #49.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
05/12/2018

Mawson Station

Figure 1 shows a SAR scene of the sea-ice zone off Mawson Station. The fast-ice edge is marked by a red outline and some icebergs that are embedded in drifting pack ice are identified by pink circles.

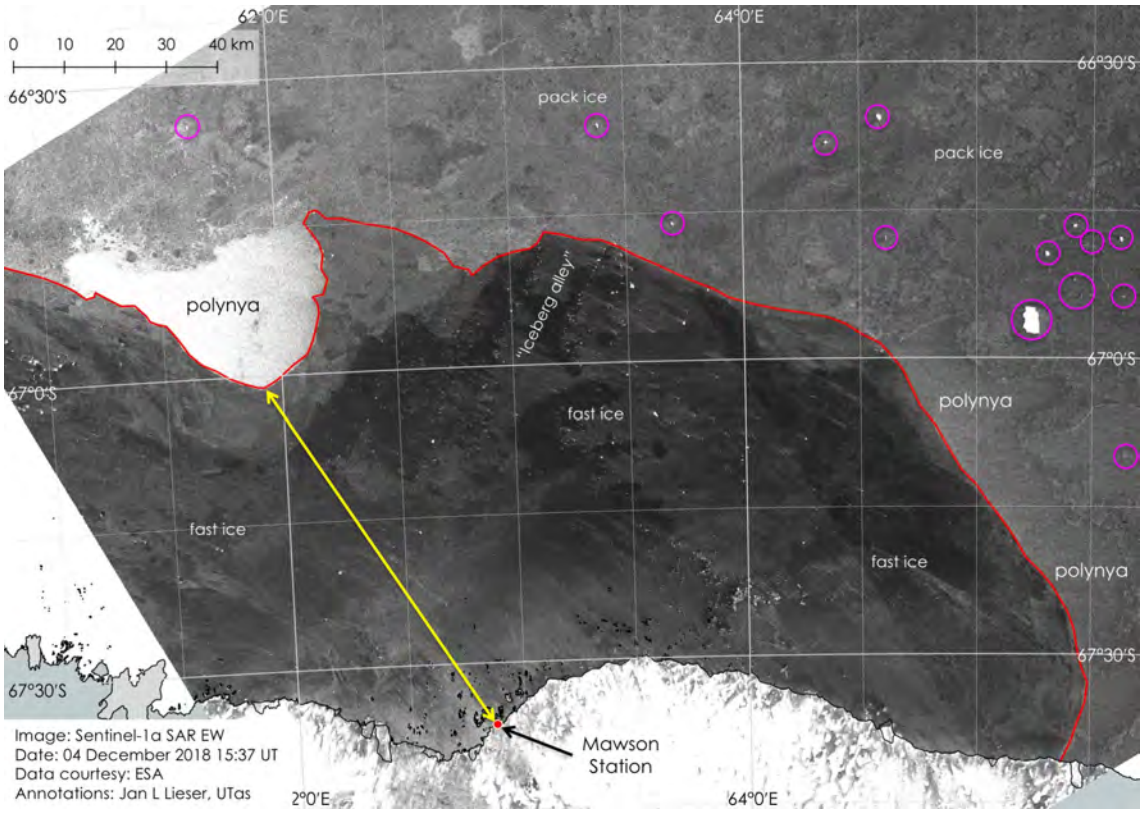

Figure 1: *Sentinel-1a SAR EW scene acquired on 04/12/2018 at 15:37 UT and provided by PolarView.*

The fast-ice edge remains still stable and the shortest distance to the polynya northwest of the station is more than 43 nautical miles.

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Casey Station

Figure 2 shows a SAR scene of the sea-ice zone north of Casey Station (a diagonal, broken white line is an image processing artefact, where two tiles are stitched together). Some of the larger ridge features are marked by yellow, dashed lines and some icebergs are identified by pink circles. The fast-ice edge is marked by a red outline.

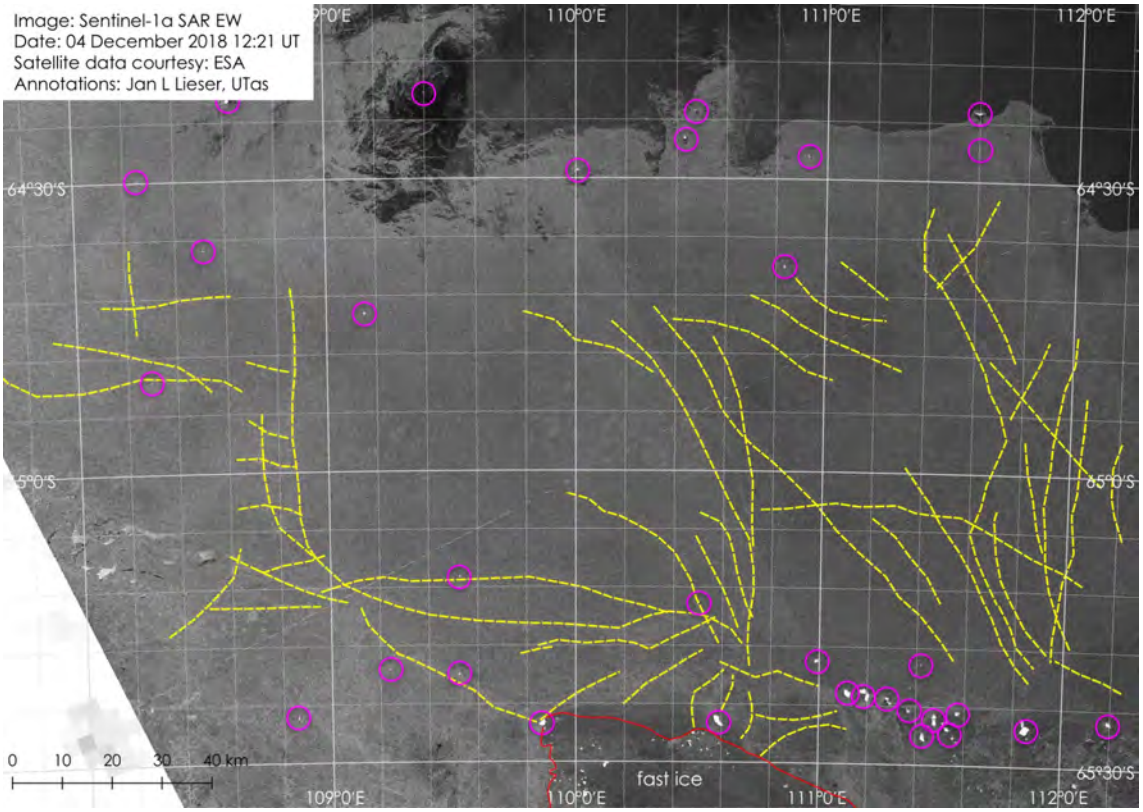

Figure 2: *Sentinel-1a SAR EW scene acquired on 04/12/2018 at 12:21 UT and provided by PolarView.*

North of the station, the open ocean is still separated from the polynya off the station by more than 70 nautical miles of high-concentration sea ice.

Figure 3 shows a sea-ice concentration chart of the east and west off Law Dome. The area covered in Figure 2 is indicated by the yellow-black frame and the same ridge features are provided in orange. The sea-ice edge from 03/12/2018 is shown as a green line.

South of 64° S, the well defined sea-ice edge has not changed significantly. Only the low concentration areas north of 64° S are drifting eastward and are dispersing.

D'Urville Sea

Figure 4 shows a SAR scene of the sea-ice zone north of Cape Denison. The fast-ice edge is marked by a red outline (dashed for 26/11/2018).

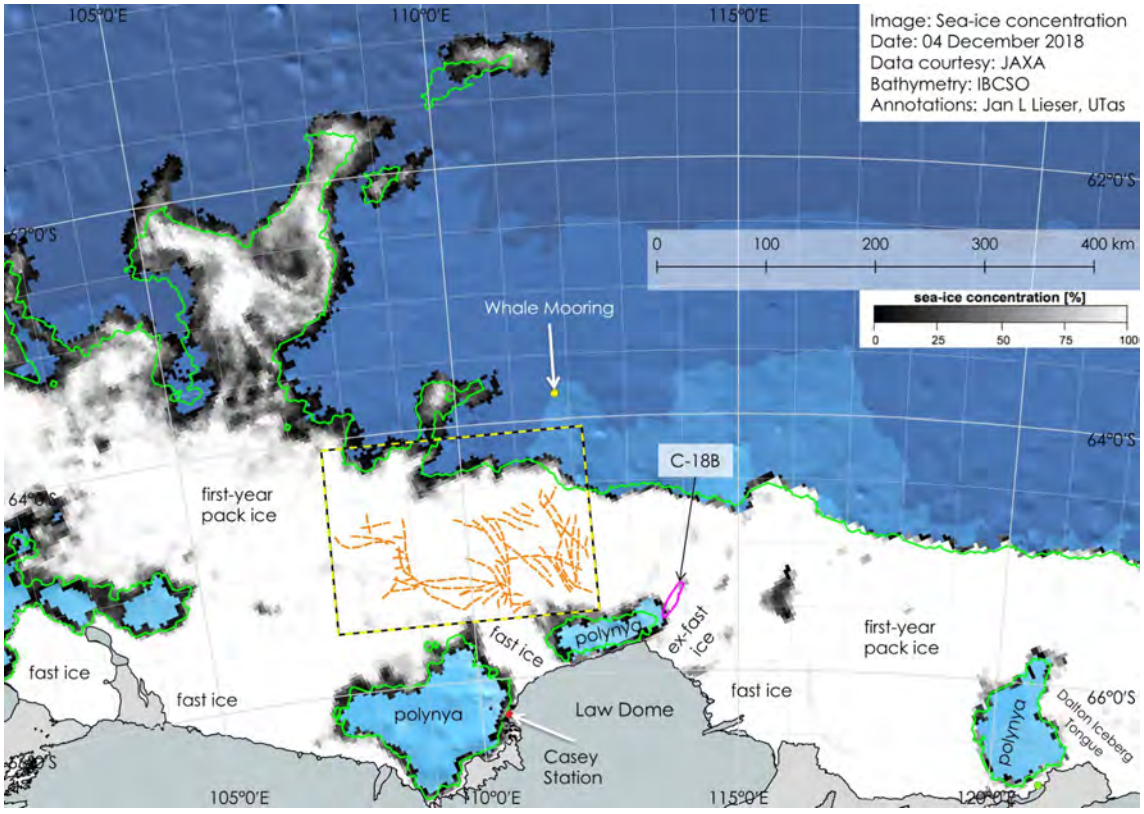

Figure 3: *Sea-ice concentration data acquired 04/12/2018 and provided by ICDC, Universität Hamburg.*

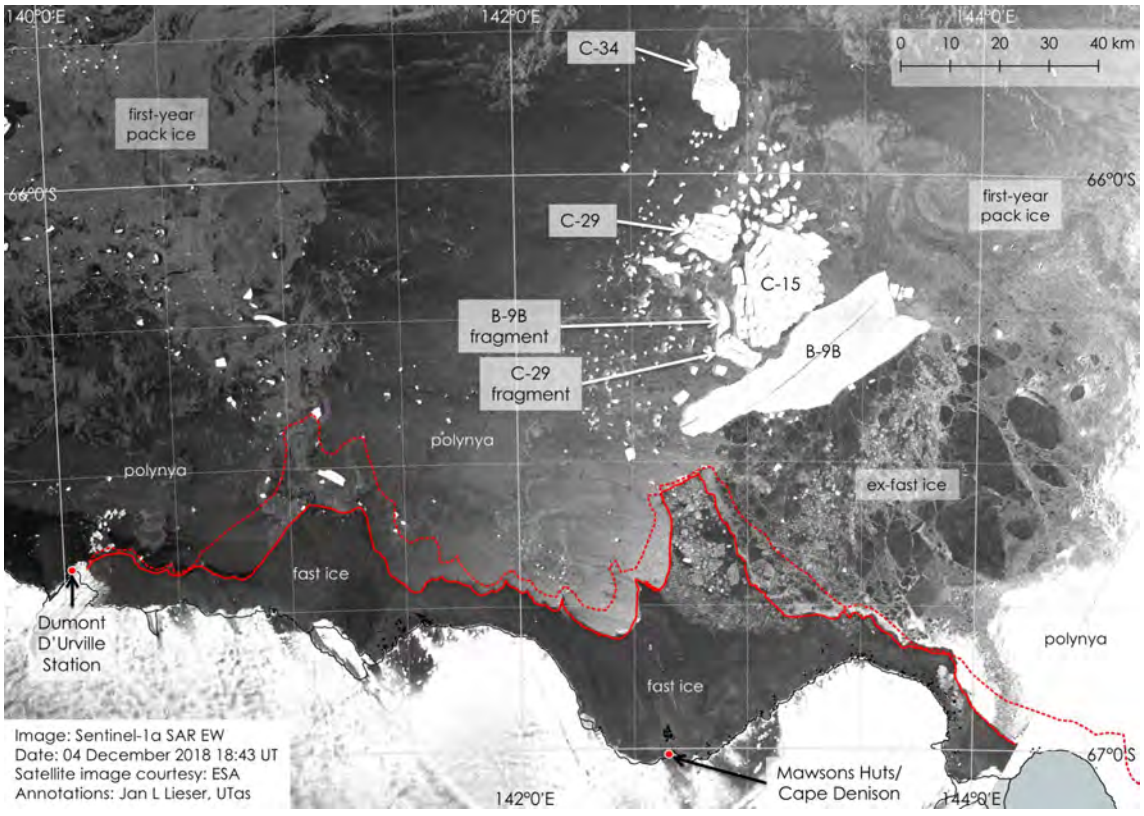

Figure 4: *Sentinel-1a SAR EW scene acquired on 04/12/2018 at 18:43 UT and provided by PolarView.*

Sea Ice Report #49.5/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
06/12/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea with the sea-ice edge on 02/12/2018, 03/12/2018 and 04/12/2018 marked as an orange, yellow and green line, respectively. The black-white frame in the northwestern corner of Figure 1 gives the extent of a Synthetic Aperture RADAR swatch, of which a part is shown in Figure 2.

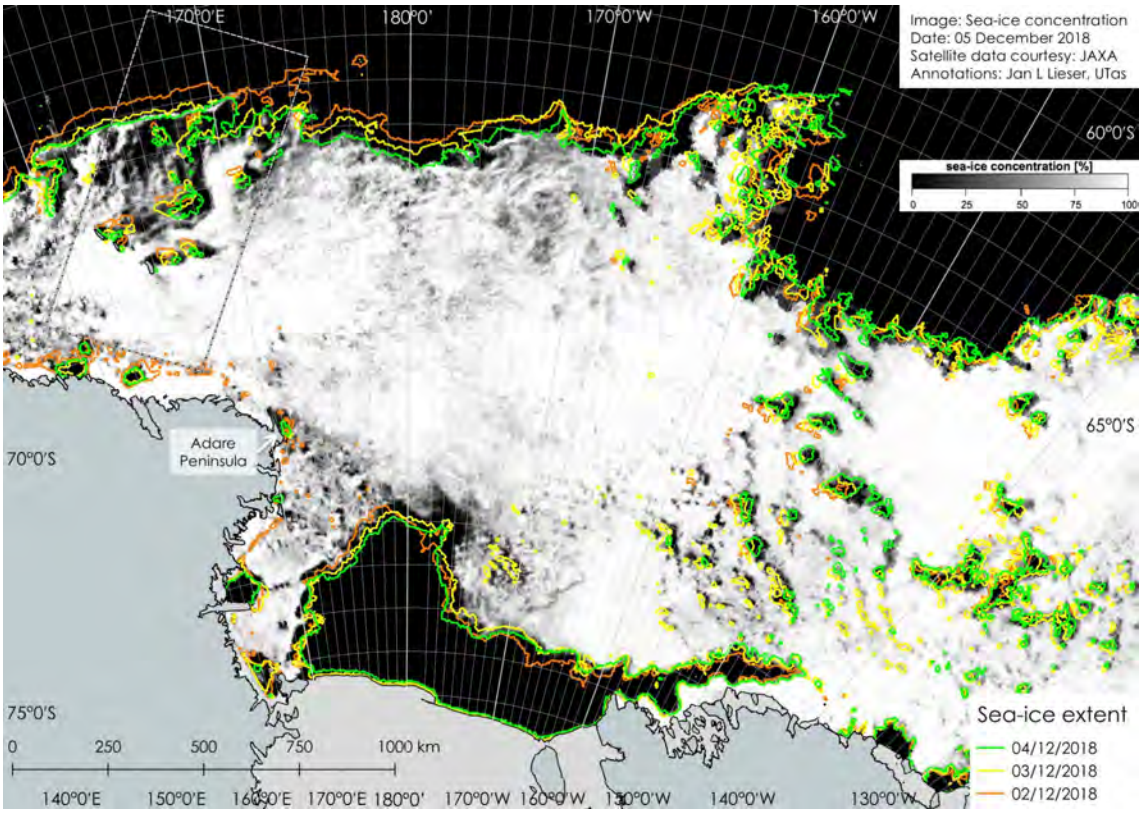

Figure 1: *Sea-ice concentration data acquired 05/12/2018 and provided by ICDC/Universität Hamburg.*

In the Ross Sea, sea ice now shows consistent retreat from the north and the south (off the Ross Ice Shelf, where polynya continues to grow).

North of the Balleny Islands (west of 165° E, see Figure 2), the extent of broken sea ice (low sea-ice concentration) is demonstrated with the

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high-resolution SAR scene. The sea-ice edge (based on the sea-ice concentration data shown in Figure 1) is additionally marked by the blue line in Figure 2. The much coarser resolution of the sea-ice concentration data (and a time lag of a few hours in data acquisition) explains the discrepancy between the marked sea-ice edge and the viewable distribution of sea ice, particularly where it appears in strips and patches.

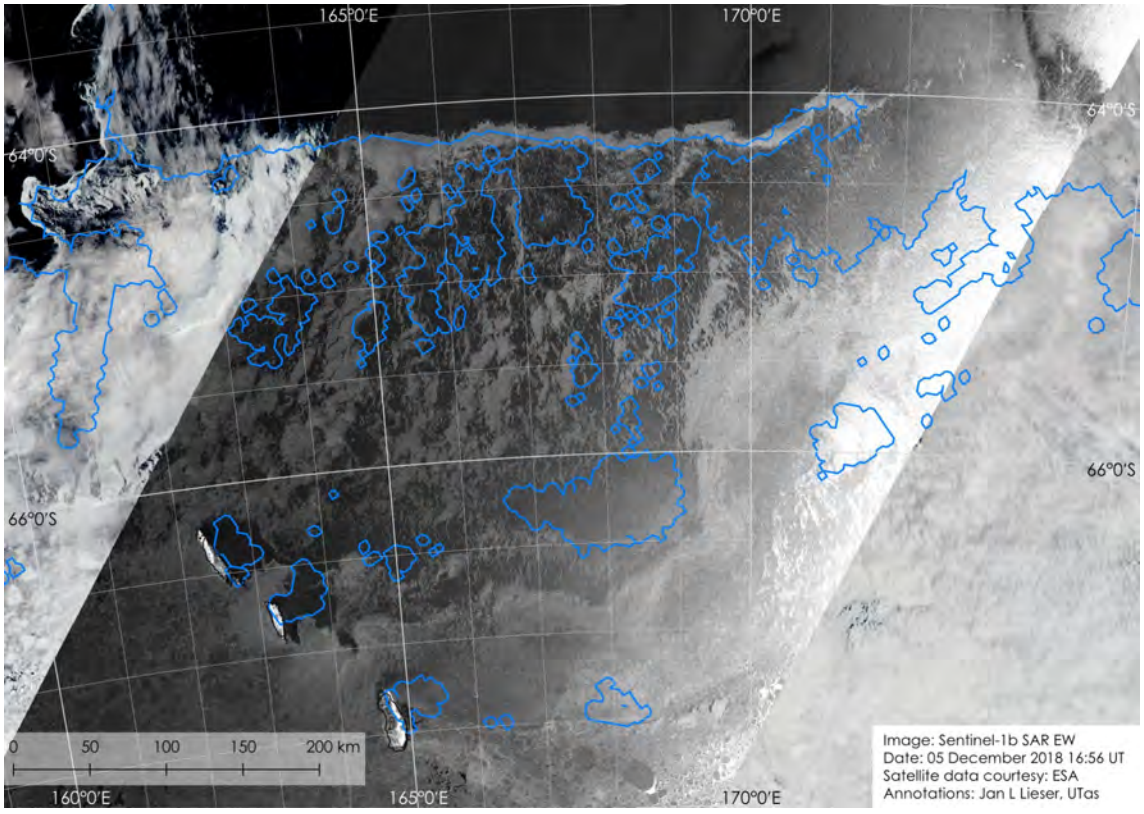

Figure 2: *Sentinel-1b SAR EW scene acquired 05/12/2018 at 16:56 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired 05/12/2018 and provided by NASA.*

The SAR scene is complemented by visible data, which are affected by thin clouds.

Sea Ice Report #50.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
10/12/2018

Casey Station

Figure 1 shows a SAR scene of the sea-ice zone north of Casey Station. Some of the larger ridge features are marked by yellow, dashed lines. The fast-ice edge is marked by a red outline.

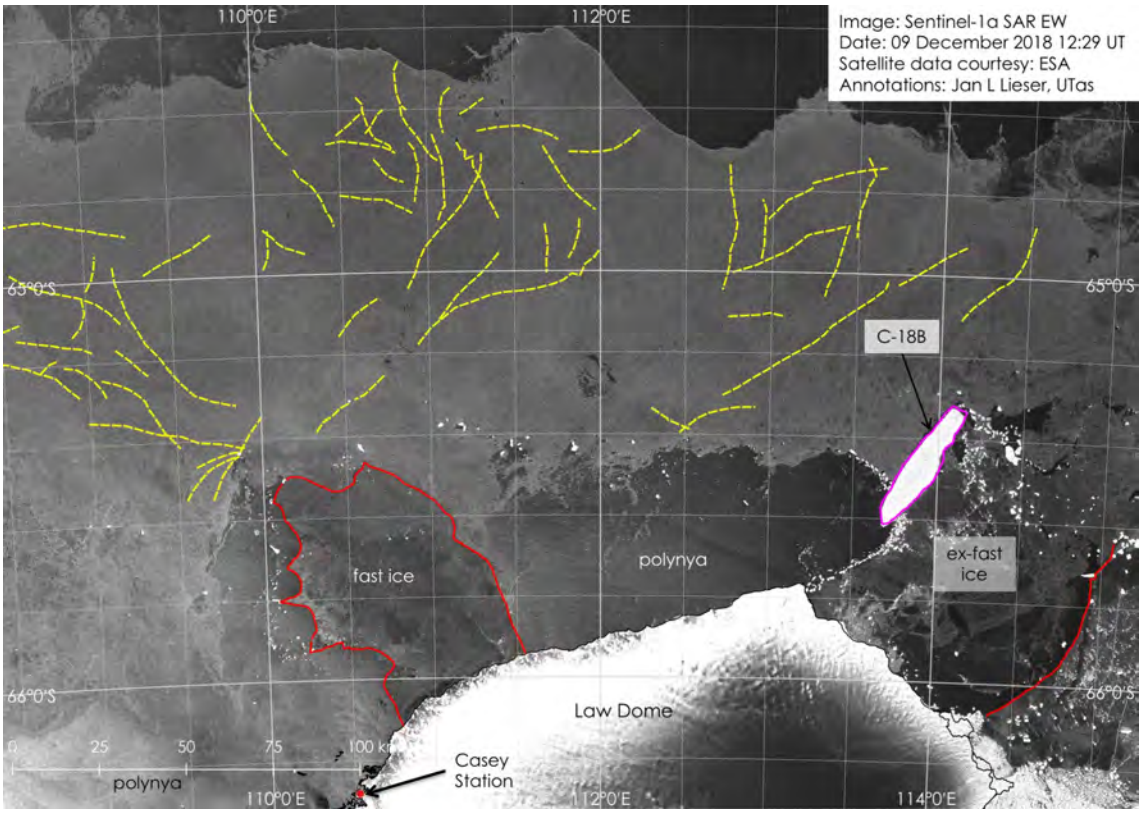

Figure 1: *Sentinel-1a SAR EW scene acquired on 09/12/2018 at 12:29 UT and provided by PolarView.*

North of the station, the open ocean is still separated from the polynya off the station by roughly 70 nautical miles of high-concentration sea ice. The northern sea-ice edge has not changed its general shape significantly, but east of 112° E, the edge is slightly more south than on 04/12/2018 (see Sea Ice Report #49.4/2018).

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Sabrina Coast

Figure 2 shows a visible scene off the Moscow University Ice Shelf. The typical eastern boundary of the Dalton Iceberg Tongue is indicated by the dashed, red line. The current fast-ice edge is marked by a solid, red line.

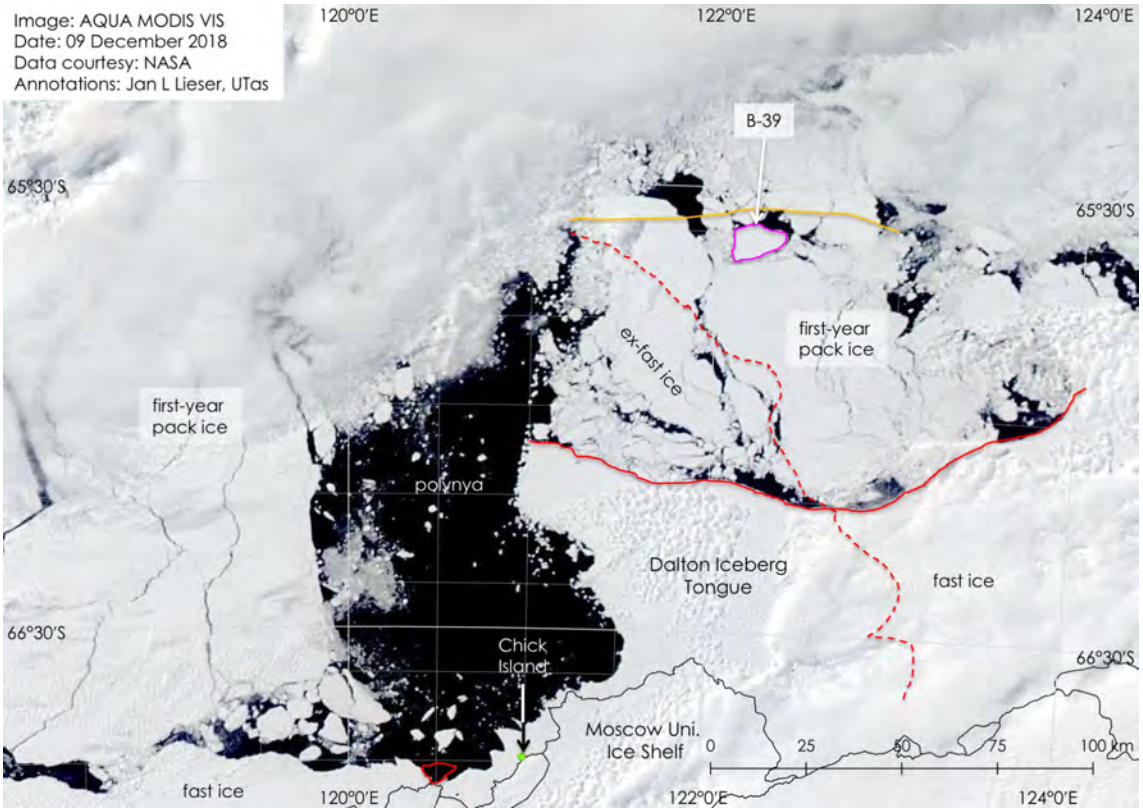

Figure 2: *AQUA MODIS VIS data acquired 09/12/2018 and provided by NASA.*

Since 03/12/2018, a large proportion of the fast ice between the icebergs of the Dalton Iceberg Tongue has been broken up and pushed eastward. East of this fast ice, first-year pack ice had accumulated and its northern boundary (separating it from the generally westward drifting pack ice north of the ice tongue) is indicated by the orange line (on 03/12/2018).

Off Chick Island, the fast-ice edge remained unchanged during this time period, but west of Chick Island, some fast ice has also broken off (red outline at 120° 30' E) and drifted northward.

Sea Ice Report #50.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
10/12/2018

Mawson Station

Figure 1 shows a visible scene of Mawson Station and offshore.

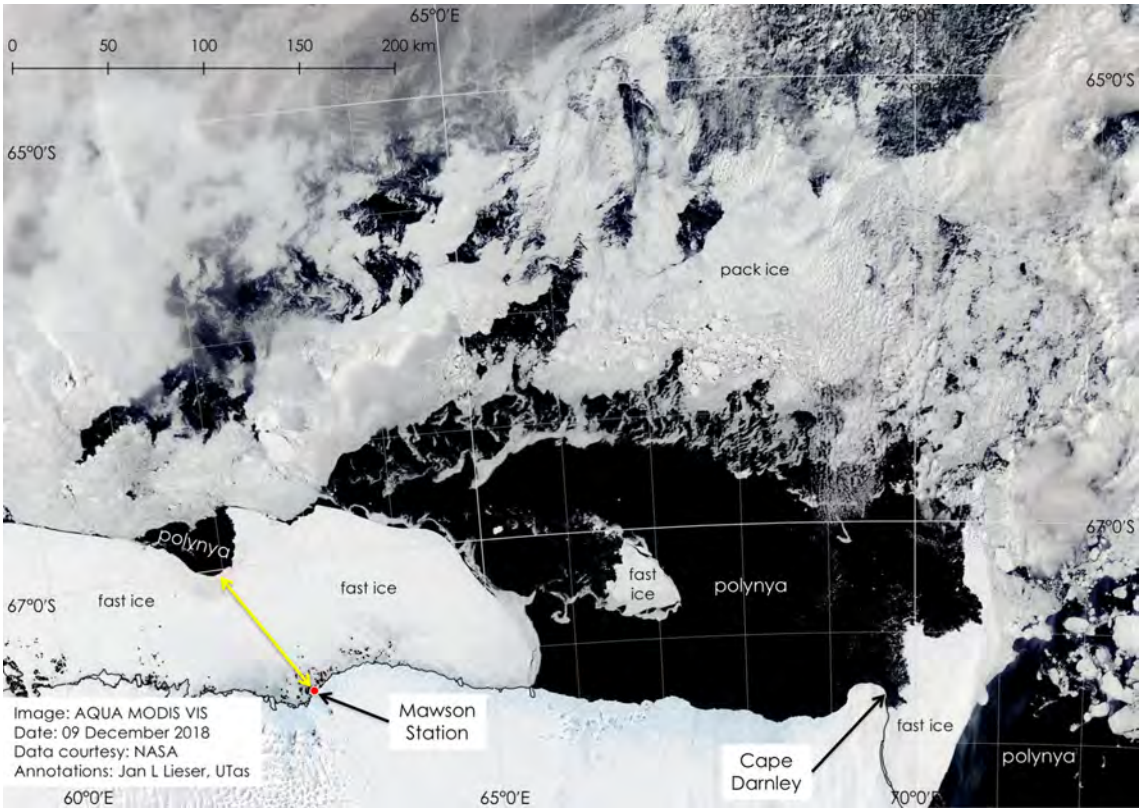

Figure 1: *AQUA MODIS VIS scene acquired on 09/12/2018 and provided by NASA.*

Off the station, the fast-ice edge remains largely unchanged and the so-called 'northwest polynya' is still more than 42 nautical miles away (yellow arrow). While east of Cape Darnley, the shape of the fast ice also remains largely unchanged, the island of fast ice that is not attached to the coastline is shedding ice at its eastern fringe.

North of 67° S, the pack ice reveals large holes and patches of very low sea-ice concentration are almost reaching the fast-ice edge west of 63° E.

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Larsemann Hills

Figure 2 shows a high-resolution SAR scene of the fast ice north of the Larsemann Hills (the home of Zhongshan Station, Progress-2 Station and Bharati Station). The position of MV *Xue Long* (Call-sign BNSK) is marked by a red circle.

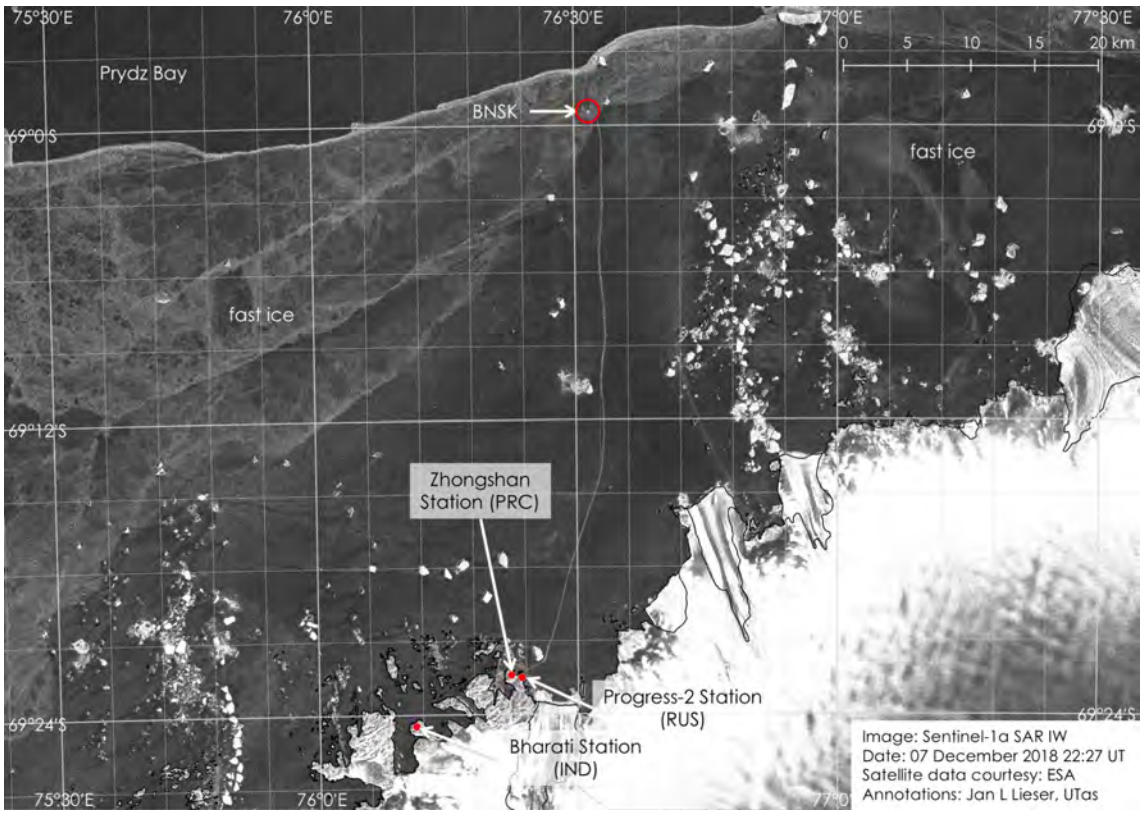

Figure 2: *Sentinel-1a SAR IW scene acquired on 07/12/2018 at 18:43 UT and provided by PolarView.*

After the vessel had reached a position roughly 2 nautical miles south of the fast-ice edge, an ice road appears to be established across the fast ice (roughly 46 km as seen by the light-grey north-south line).

Sea Ice Report #50.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
11/12/2018

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for November 2018.

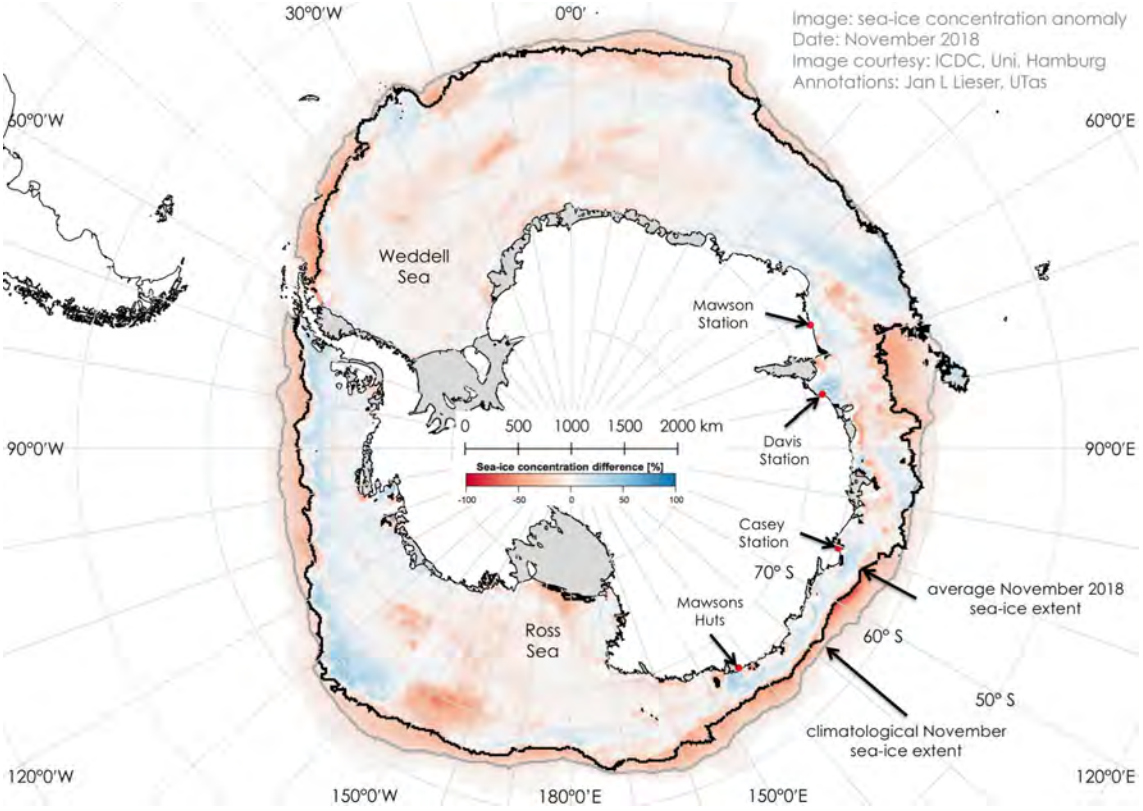

Figure 1: *Sea-ice concentration anomaly for November 2018 provided by ICDC, Universität Hamburg.*

In November 2018, sea-ice extent remains below average (relative to 1992-2017) conditions throughout most of Antarctica, as can be seen by the almost continuous red sea-ice margin in the chart (Figure 1).

In East Antarctica, low sea-ice extent is accompanied by below average sea-ice concentration west of 90° E (except off Prydz Bay/Davis Station and a large patch of sea ice at 80° E and 58° S), but above average concentration within lower extent between 105° E and 145° E.

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Sea Ice Report #50.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
11/12/2018

Casey Station

Figure 1 shows a very-high resolution (15 m horizontal) panchromatic scene of Casey Station and vicinity. The fast-ice edge is marked by a red outline. (The scene was captured at 03:09 hrs. in the morning of 11/12/2018 local time, hence the apparent illumination from the south.)

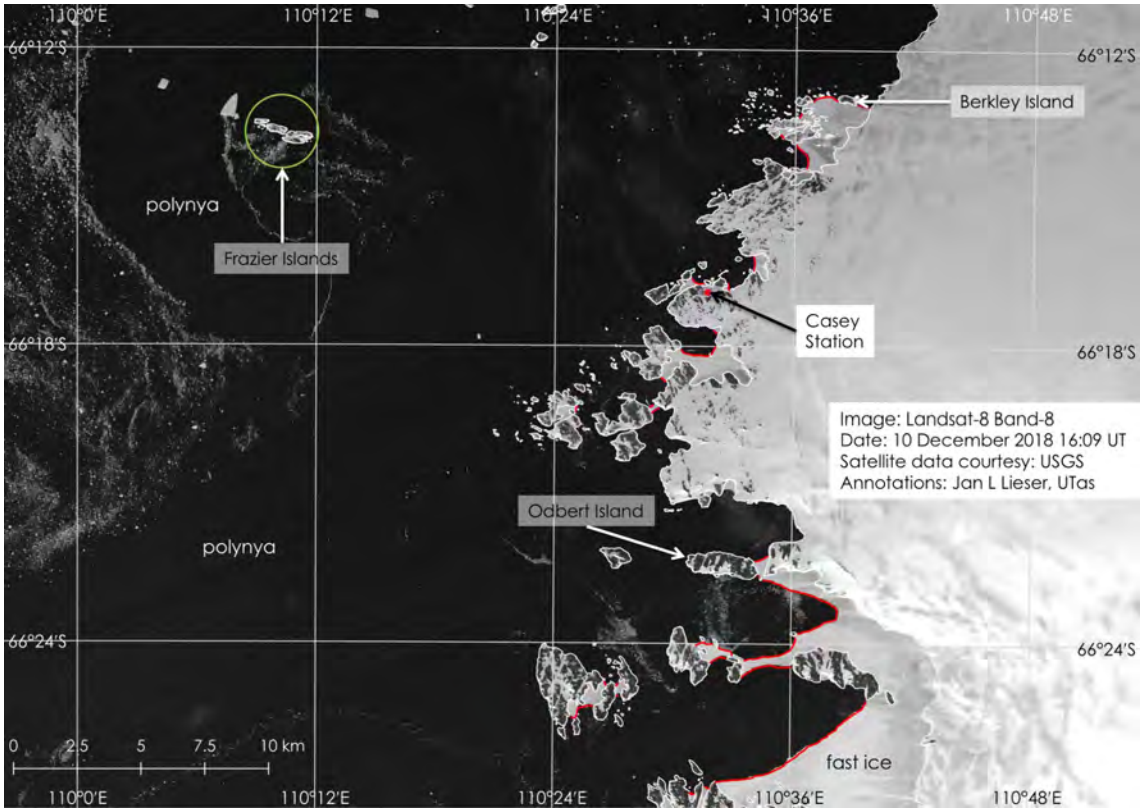

Figure 1: *Landsat-8 Band-8 (panchromatic) scene acquired on 10/12/2018 at 16:09 UT and provided by USGS.*

In the vicinity of the station, only very little fast ice remains. Some broken sea ice can be seen floating in the polynya.
Figures 2 and 3 show the same geographical frame of the pack ice north of Casey Station as a thermal infra-red (TIR) and a panchromatic scene, respectively. West of 108° E, the TIR scene is partly affected by thin clouds, which are not opaque in the panchromatic image.

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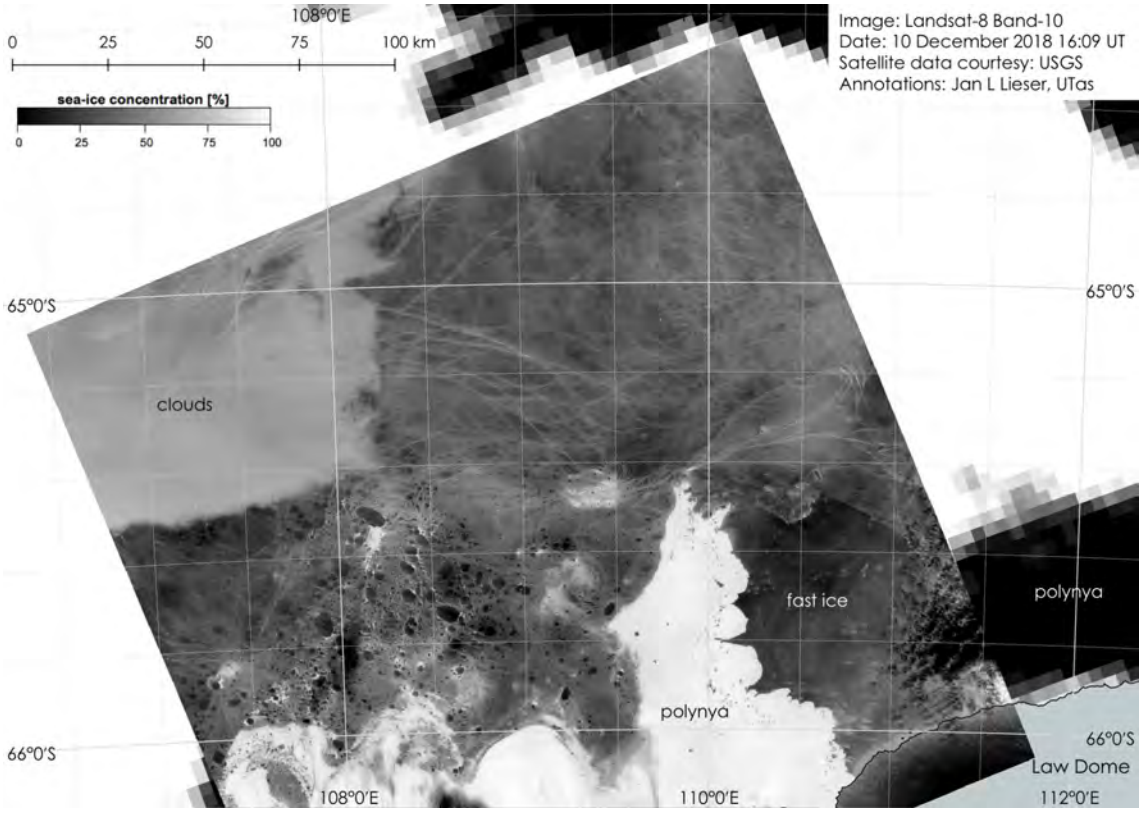

Figure 2: *Landsat-8 Band-10 (TIR) scene acquired on 10/12/2018 at 16:09 UT and provided by USGS; complemented by sea-ice concentration data acquired 10/12/2018 and provided by Universität Hamburg.*

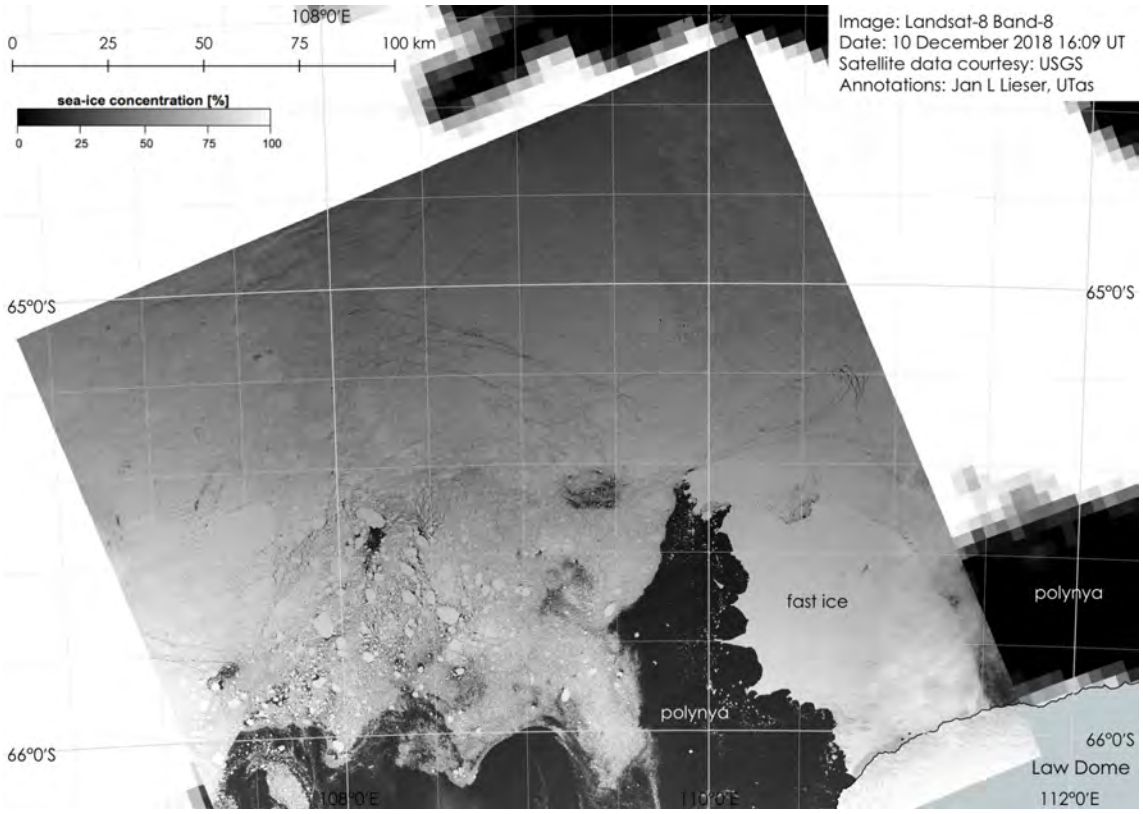

Figure 3: *Landsat-8 Band-8 (panchromatic) scene acquired on 10/12/2018 at 16:09 UT and provided by USGS; complemented by sea-ice concentration data acquired 10/12/2018 and provided by Universität Hamburg.*

In the thermal infra-red scene, a warmer surface shows bright (almost white ocean in the polynya) and a colder surface darker (almost black ice sheet of Law Dome). As with Figure 1, the early local time of the data acquisition results in an apparent illumination from the south of Figure 3.

Some of the large, kinematic features identified in previous SAR imagery (see Sea Ice Reports #49.3/2018, #49.4/2018 and #50.1/2018) are seen in detail here as well. A temporary reduction in northerly winds allowed for a short-term release of pressure on the highly concentrated pack ice. This explains brighter lines within the ice pack showing in the TIR data, where seawater is reaching the surface. Similarly, visibly dark ocean appears along the same lines in the panchromatic data. Along the edges of these lines, deformed sea ice of the previously compacted floes is likely to be still present.

Figure 4 shows an enlarged portion of Figure 1 to highlight the local extent of fast ice off Casey Station.

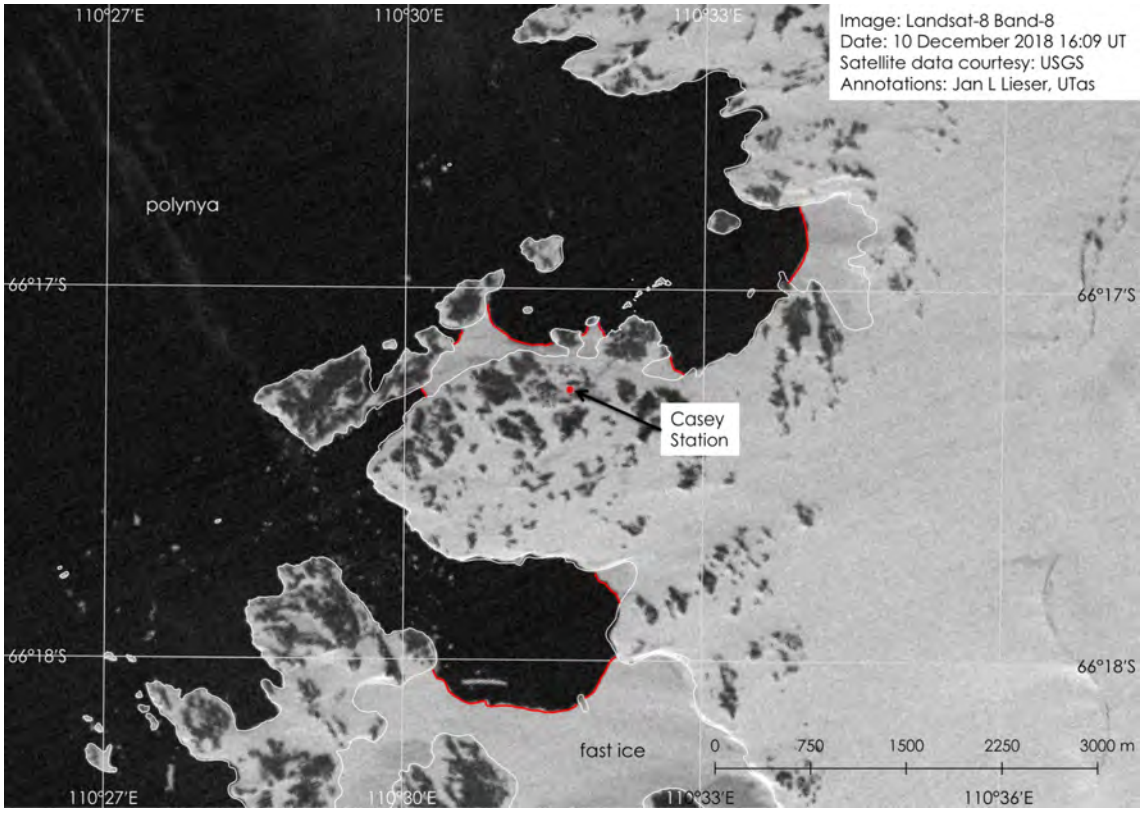

Figure 4: *Landsat-8 Band-8 (panchromatic) scene acquired on 10/12/2018 at 16:09 UT and provided by USGS.*

Sea Ice Report #50.5/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/12/2018

Sabrina Coast

Figure 1 shows a high-resolution SAR scene off the Moscow University Ice Shelf. The fast-ice edge on 27/11/2018 is marked by a dashed, red line.

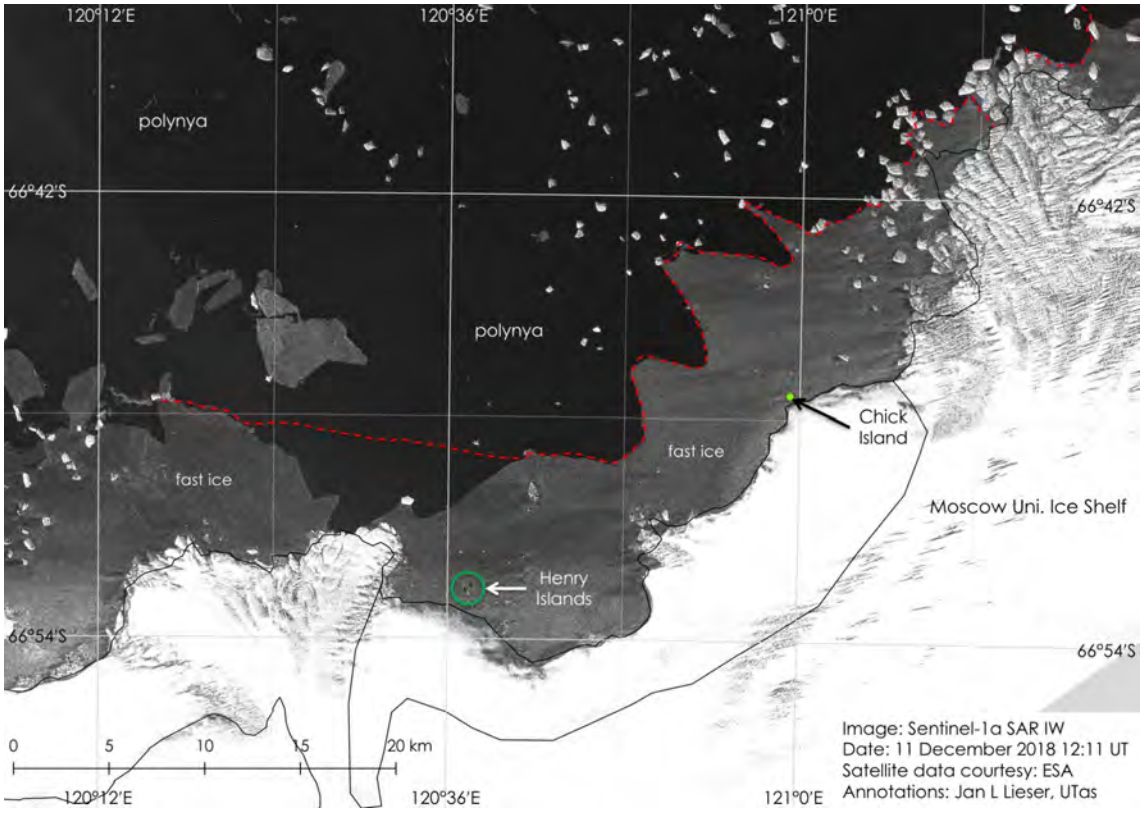

Figure 1: *Sentinel-1a SAR IW data acquired 11/12/2018 at 12:11 UT and provided by PolarView.*

Off Chick Island, the fast-ice edge remains largely unchanged since late November, but west of Chick Island, some fast ice has broken off (west of 120° 40' E) and drifted northward.

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Sea Ice Report #50.6/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/12/2018

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea with the sea-ice edge on 07/12/2018, 08/12/2018, 09/12/2018 and 10/12/2018 marked as a red, orange, yellow and green line, respectively.

The blue, cyan and magenta frames mark the extent of Synthetic Aperture RADAR scenes of Figure 2, Figure 3 and Figure 4, respectively. The sea-ice edge (based on the sea-ice concentration data shown in Figure 1) is additionally indicated by a white outline in Figures 2, 3 and 4.

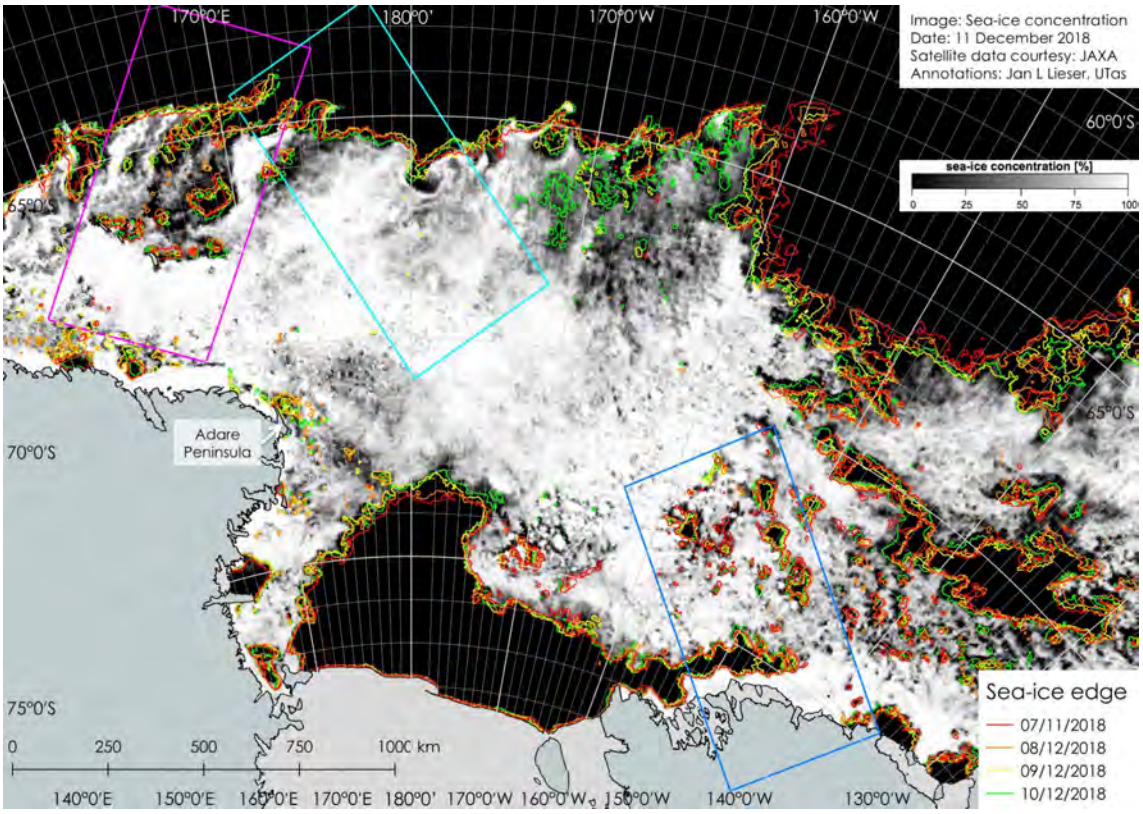

Figure 1: *Sea-ice concentration data acquired 11/12/2018 and provided by ICDC/Universität Hamburg.*

In the Ross Sea, sea ice shows consistent pattern of retreat from the north and the south (off the Ross Ice Shelf, where polynya continues to grow).

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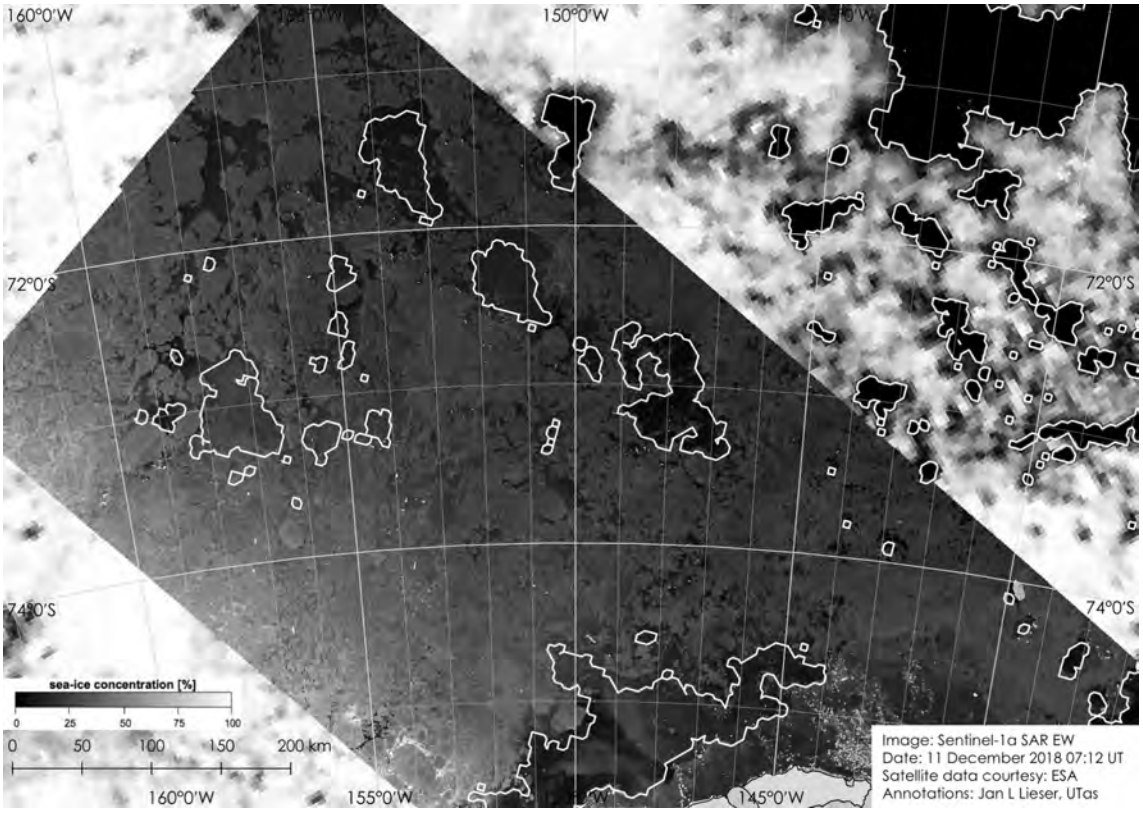

Figure 2: *Sentinel-1a SAR EW scene acquired 11/12/2018 at 07:12 UT and provided by PolarView; complemented by sea-ice concentration data shown in Figure 1.*

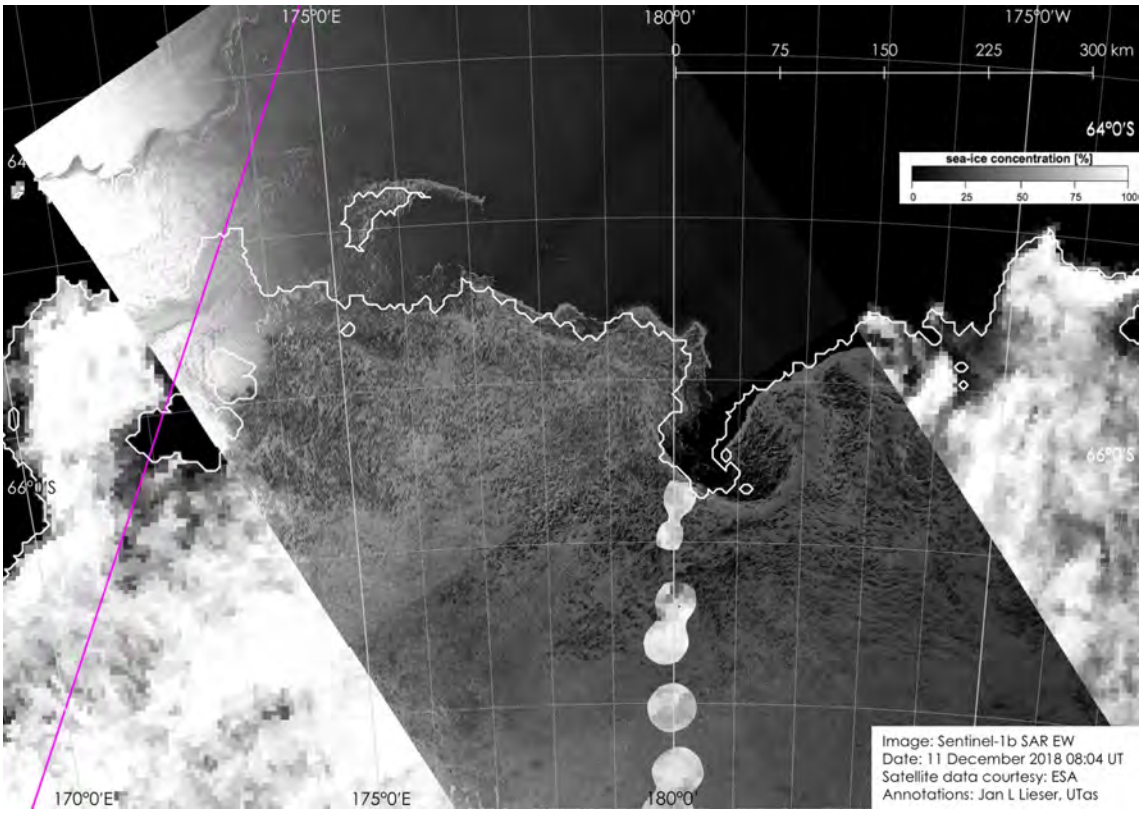

Figure 3: *Sentinel-1b SAR EW scene acquired 11/12/2018 at 08:04 UT and provided by PolarView; complemented by sea-ice concentration data shown in Figure 1. (Punch holes along 180° are a SAR data processing artefact.)*

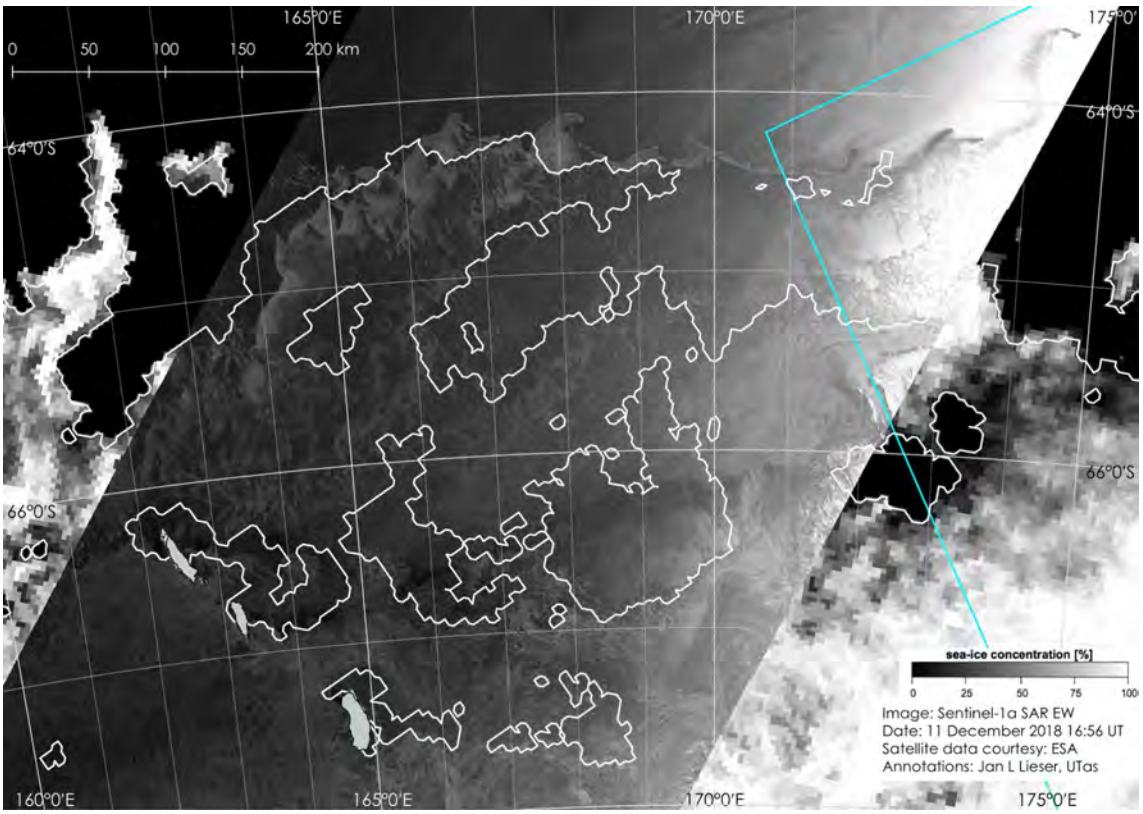

Figure 4: *Sentinel-1a SAR EW scene acquired 11/12/2018 at 16:56 UT and provided by PolarView; complemented by sea-ice concentration data shown in Figure 1.*

South of 70° S, some large sea-ice floes can be identified in the matrix of varying sea-ice concentration (see Figure 2). But further north, sea ice consists predominantly of smaller, decaying floes (as evident in Figures 3 and 4).

North of the Balleny Islands (west of 165° E, see Figure 4), strips and patches of sea ice (very low sea-ice concentration) are not captured by the much coarser resolution of the sea-ice concentration data

Sea Ice Report #50.7/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/12/2018

Casey Station

Figure 1 shows a high resolution SAR scene of sea ice north of Casey Station. The cruise track of RSV *Aurora Australis* (call-sign VNAA) is given by the white line, where red dots mark roughly 6-minute intervals. The position of the vessel at the time of the image acquisition (at 12:44 UT) can be clearly identified as a bright spot in the enlarged zoom.

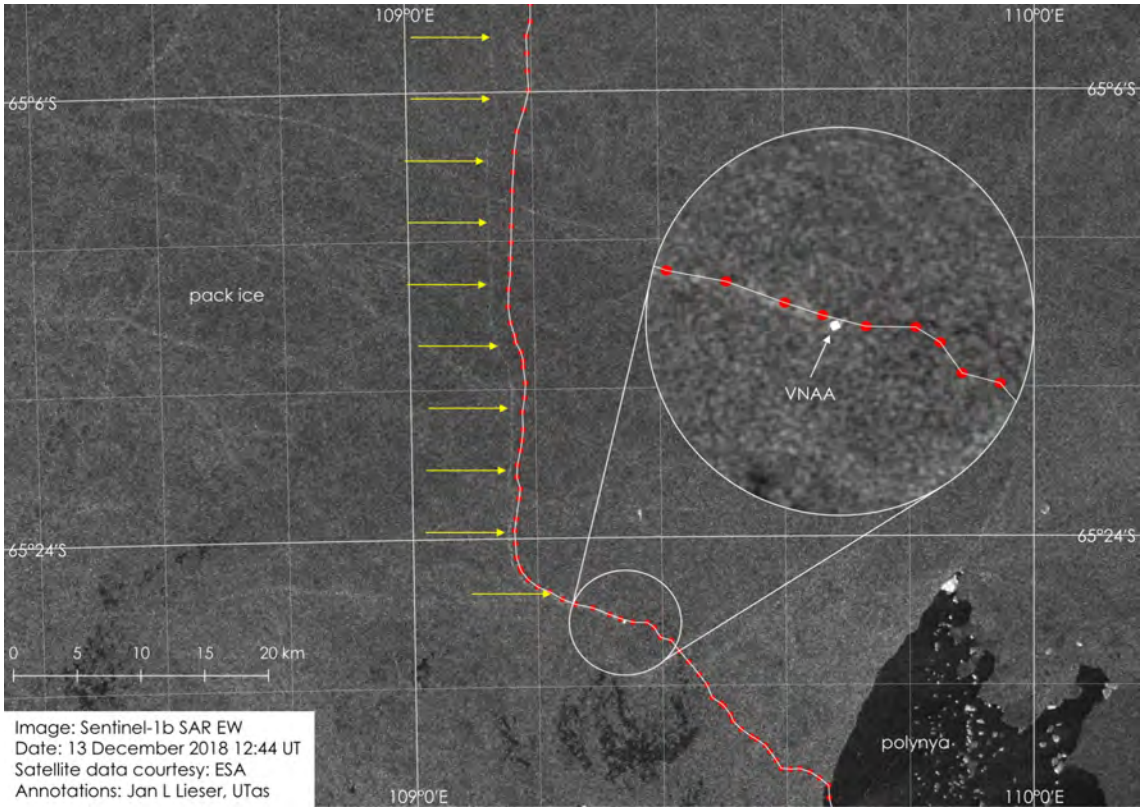

Figure 1: *Sentinel-1b SAR EW scene acquired on 13/12/2018 at 12:44 UT and provided by PolarView.*

Broken sea ice in the path of the vessel also shows as a white line (marked by yellow arrows). The westward drift of the pack ice is visible through the increasing displacement of the line of broken ice west of the cruise track. Figure 1 shows roughly 5 hours of cruise track prior to the vessel's in-situ position, which allows for sea-ice drift speed to be estimated at 0.3 kn.

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Sea Ice Report #51.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
17/12/2018

Davis Station

Figure 1 shows a high resolution SAR scene of Davis Station and offshore. Positions of a large iceberg (a fragment of iceberg D-15B off the West Ice Shelf) during the past fortnight are marked by coloured and annotated shapes.

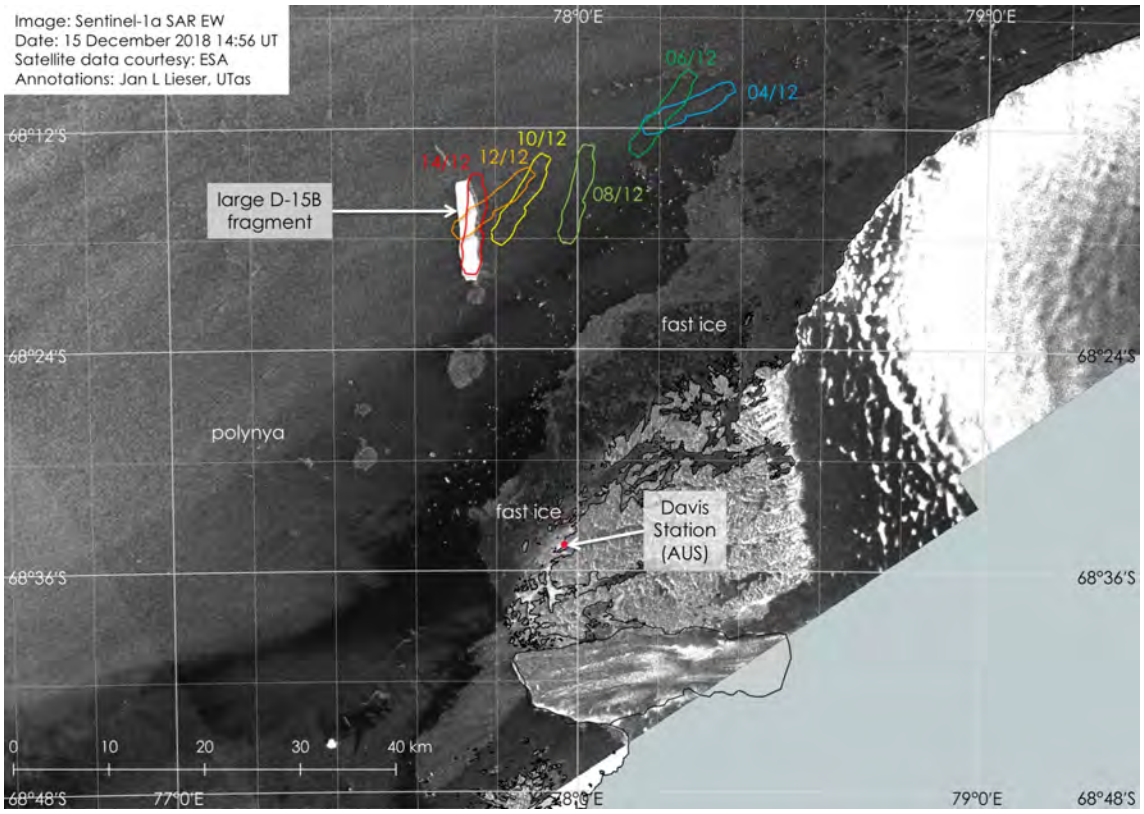

Figure 1: *Sentinel-1b SAR EW scene acquired on 15/12/2018 at 14:56 UT and provided by PolarView.*

Small pieces of fast ice are breaking off the edge of the shore-fast sea ice. On 04/12/2018, this has released a large iceberg that was temporarily locked in by fast ice (this resting position of the iceberg is marked by a blue shape). That position was in roughly 150 m water depth. The current location of the iceberg is in about 450 m water depth, which means it is generally drifting freely on it's southwestern course along the coast.

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Sabrina Coast

Figure 2 shows a visible scene of sea ice north of the Moscow University Ice Shelf.

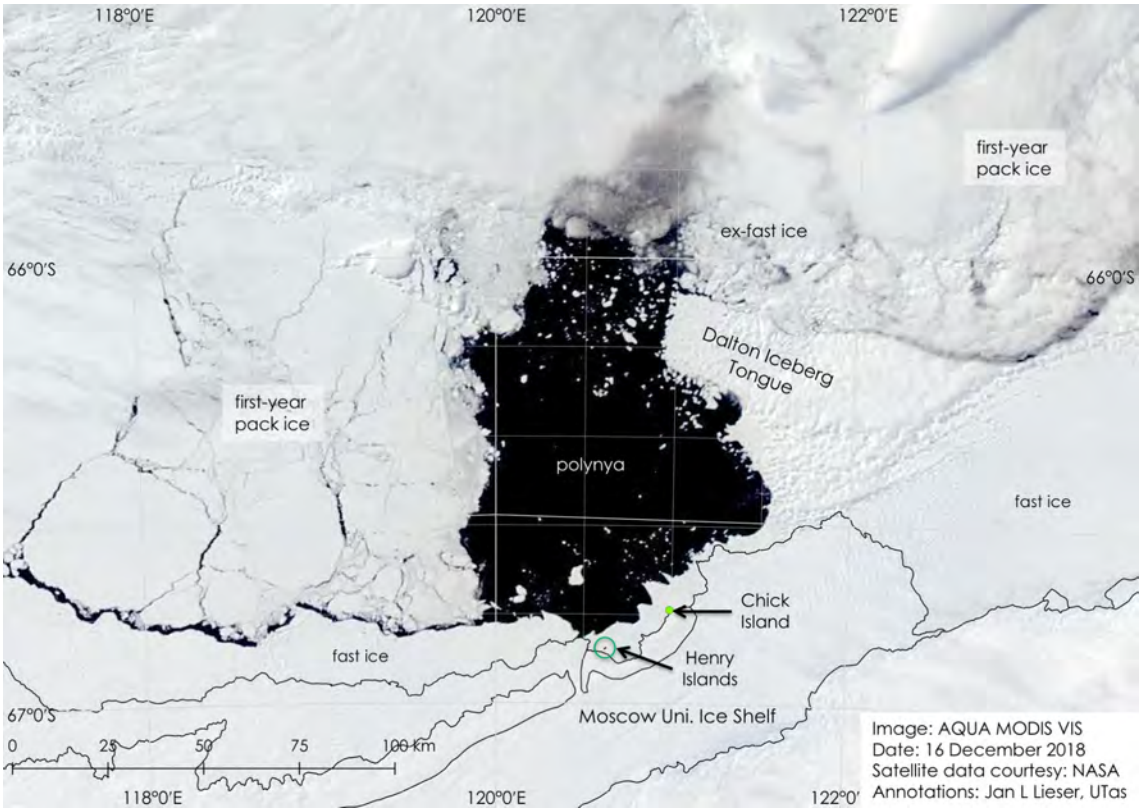

Figure 2: *AQUA MODIS VIS scene acquired on 16/12/2018 and provided by NASA.*

Off Chick Island, the fast-ice edge appears stable during the past week. But even though the northern half of the Dalton Iceberg Tongue is partly obscured by clouds, the broken ex-fast ice in between the icebergs of the tongue can clearly be seen.

D'Urville Sea

Figure 3 shows a visible scene of the coastline between Dumont D'Urville Station and the Mertz Ice Shelf as well as the fast-ice edge on 04/12/2018, which is marked by a dashed, red line.

Fast ice can be seen retreating towards the coast. Even though icebergs B-9B and C-15 (and a few smaller fragments) appear to be not grounded, they remain trapped amongst small icebergs, which are grounded, and are therefore restlessly moving within the small wiggle room that they have.

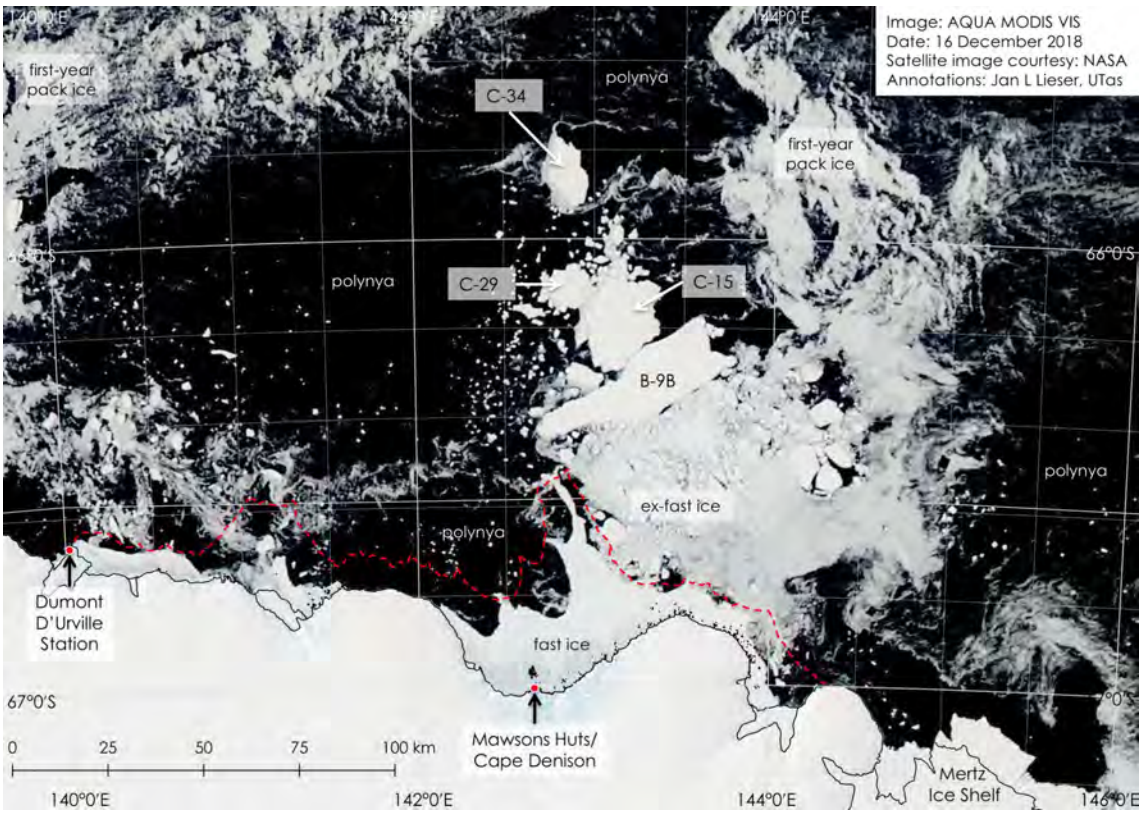

Figure 3: *Sentinel-1b SAR EW scene acquired on 13/12/2018 at 12:44 UT and provided by PolarView.*

Sea Ice Report #51.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
18/12/2018

Sabrina Coast

Figure 1 shows a high-resolution SAR scene of fast ice north of the Moscow University Ice Shelf.

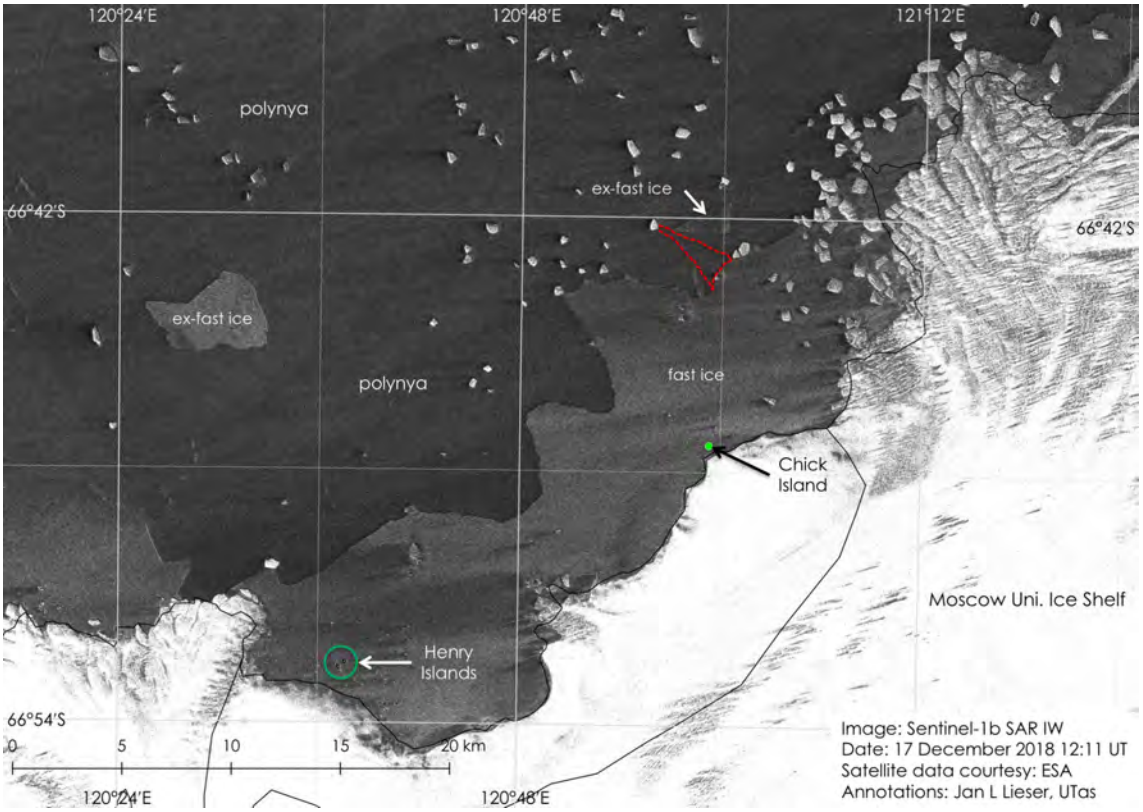

Figure 1: *Sentinel-1b SAR IW scene acquired on 17/12/2018 at 12:11 UT and provided by PolarView.*

Further to Sea Ice Report #51.1/2018, roughly 3.6 km^2 of fast ice (marked by the dashed, red shape) have broken off from the fast-ice edge over night north of Chick Island.

At this time of year, this behaviour is consistent with the generally retreating fast ice around the Antarctic coast.

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Sea Ice Report #51.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
18/12/2018

Cooperation Sea

Figure 1 shows a sea-ice concentration chart of Cooperation Sea. Additionally the median sea-ice extent for December is shown as a blue line.

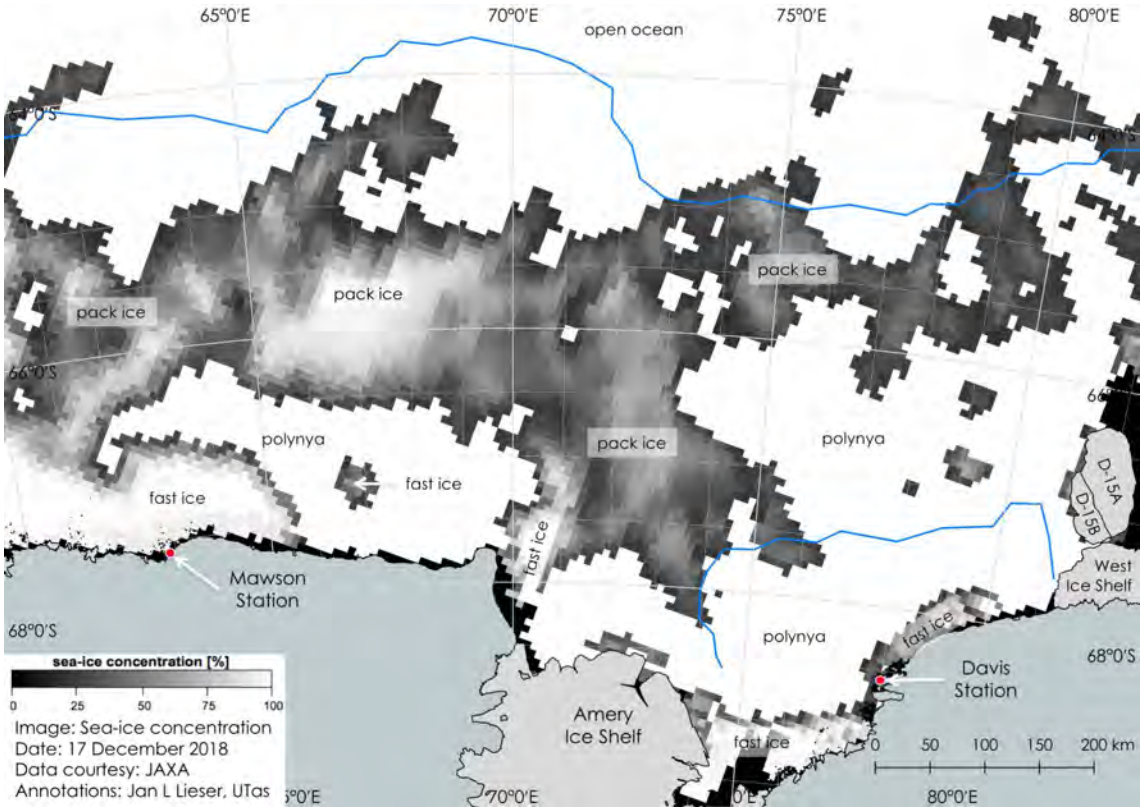

Figure 1: *Sea-ice concentration chart acquired on 17/12/2018 and provided by Drift+Noise Polar Services.*

Sea-ice concentration and extent are below what could typically be expected at this time of year in the region. While the fast ice distribution (showing in varying shades of concentration in the data of Figure 1) appears close to average for December, the pack ice is much reduced and therefore the protective barrier that shelters the fast ice from wind and wave action.

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Mawson Station

Figure 2 shows a visible scene of Mawson Station and offshore. The fast-ice edge on 09/12/2018 (see Sea Ice Report #50.2/2018) is also given by the dashed, red line.

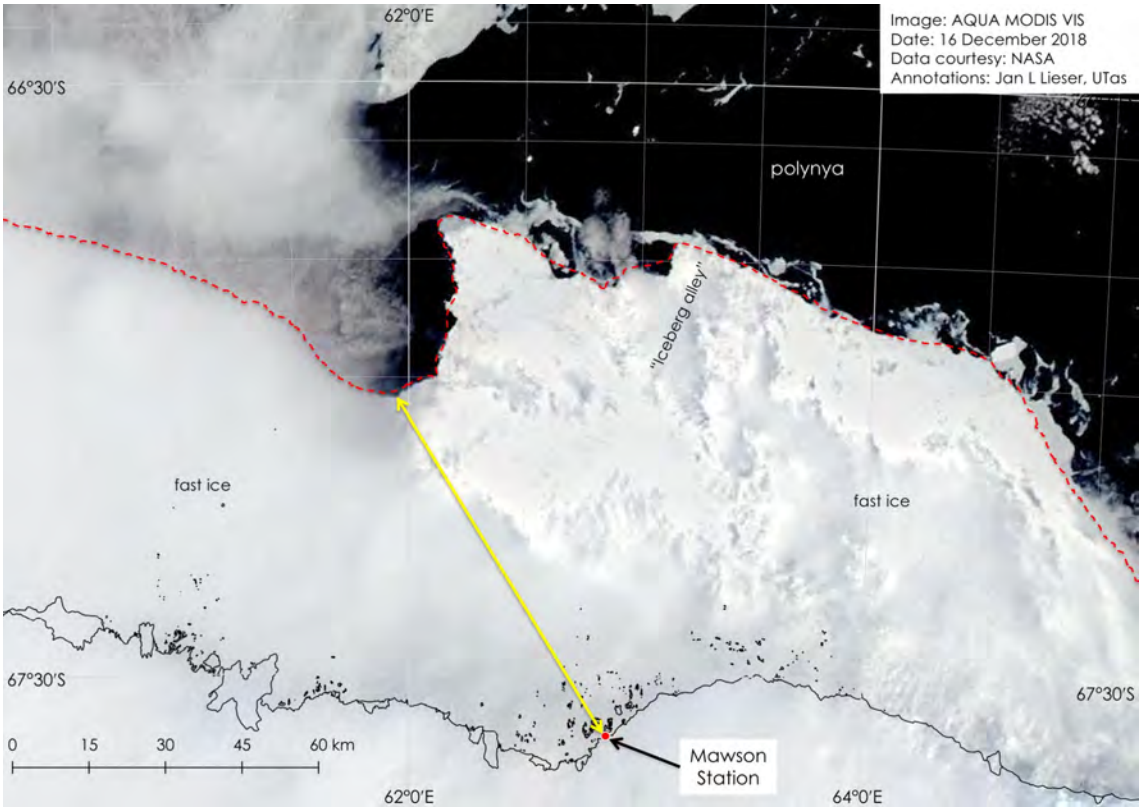

Figure 2: *AQUA MODIS VIS data acquired on 16/12/2018 and provided by NASA.*

During the past week, the fast-ice edge has only marginally changed west of the so-called "iceberg alley" and the shortest distance between open water (polynya) and Mawson Station remains close to 42 nautical miles.

Sea Ice Report #51.4/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
19/12/2018

Sabrina Coast

Figure 1 shows a SAR scene of fast ice north of the Moscow University Ice Shelf. Additionally, the fast-ice edge on 17/12/2018 12:11 UT (roughly 12 hours ago) is marked by a dashed, red line.

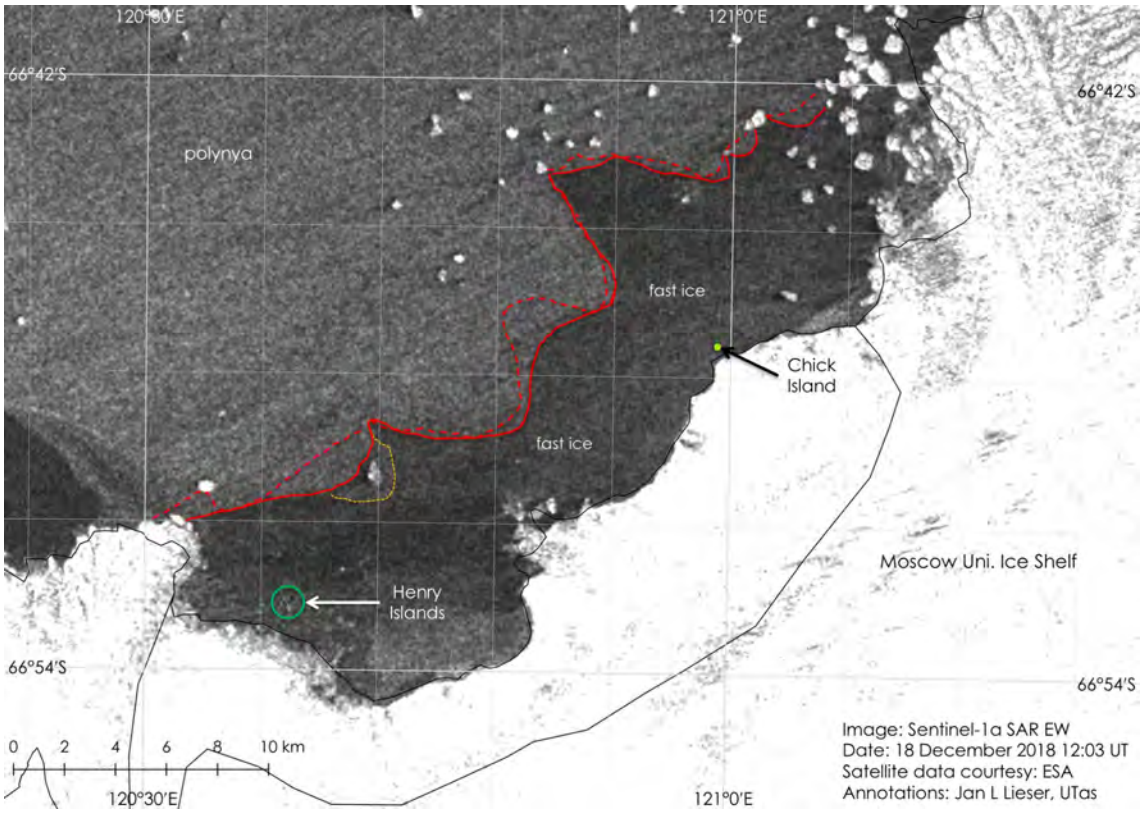

Figure 1: *Sentinel-1a SAR EW scene acquired on 18/12/2018 at 12:03 UT and provided by PolarView.*

Further to Sea Ice Report #51.2/2018, fast ice continues to brake away from the fast-ice edge off Chick Island and Henry Islands. The new fast-ice edge is marked by a solid, red line.

Continued and strengthening easterly winds over the region can contribute to further weakening of the fast-ice edge and more fast ice breaking off.

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Sea Ice Report #51.5/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
21/12/2018

Casey Station

Figure 1 shows a composite of multiple satellite data north of Law Dome. The median sea-ice extent for December is marked by the yellow line. Additionally, the sea-ice edge based on sea-ice concentration data from 20/12/2018 is given by the green line. Pink dots north of the sea-ice edge are indicative for the presence of icebergs.

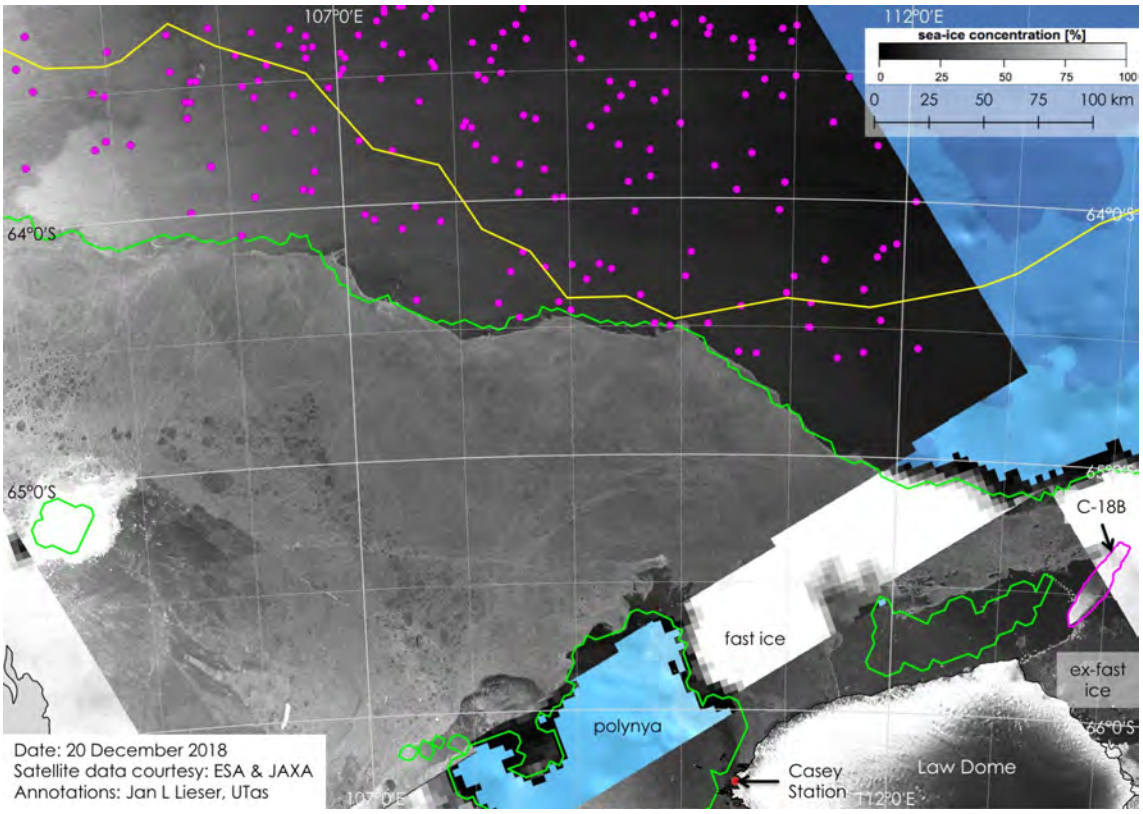

Figure 1: *Sentinel-1b SAR EW scene (northwestern part) acquired on 20/12/2018 at 12:36 UT and Sentinel-1b SAR IW scene (southeastern part) acquired on 20/12/2018 at 12:35 UT, both provided by PolarView; sea-ice concentration data acquired 20/12/2018 and provided by ICDC, Universität Hamburg; background bathymetry: IBCSO.*

Overall, sea-ice conditions have not changed significantly during the past week. North of the sea-ice edge, many small to medium (and few large) icebergs have been identified in the SAR data.

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Sea Ice Report #52.1/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
24/12/2018

Antarctica

Figure 1 shows a sea-ice concentration chart for Antarctica. The green line indicates the median sea-ice extent for December.

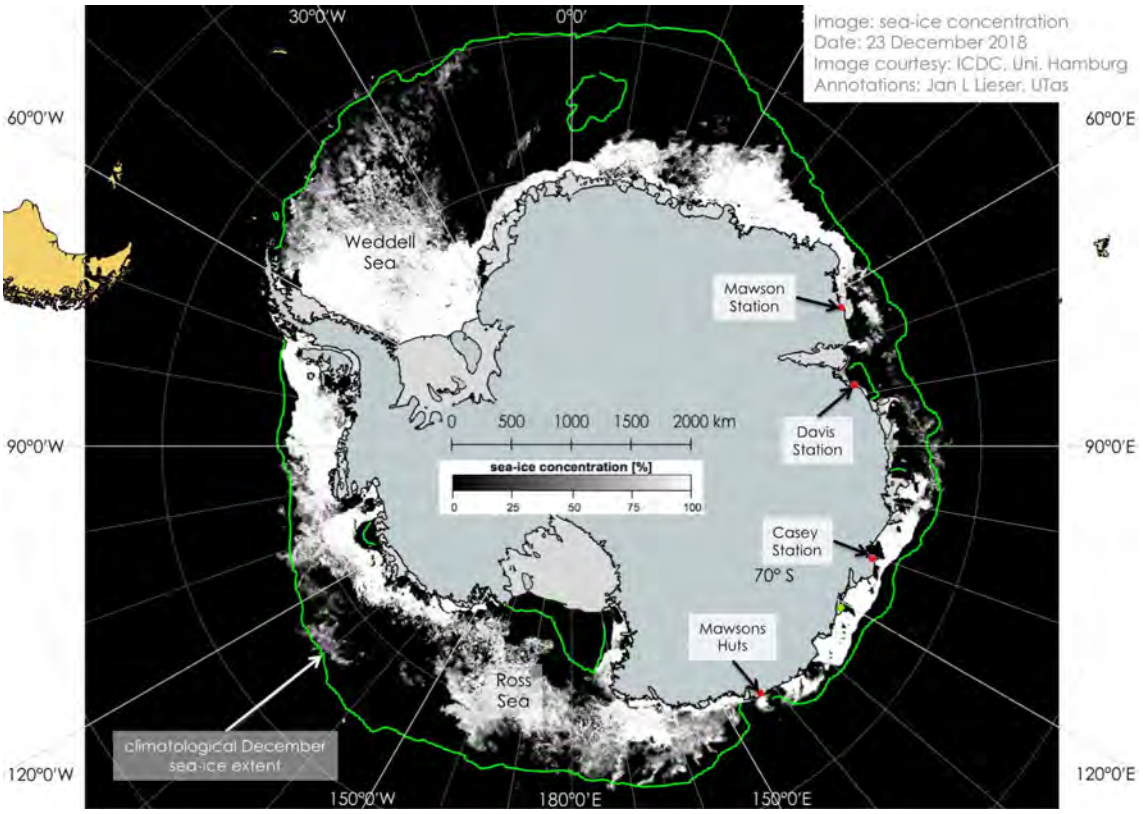

Figure 1: *Sea-ice concentration data acquired 23/12/2018 and provided by ICDC, Universität Hamburg.*

The daily sea-ice area is currently only slightly above 4×10^6 km^2, which is the lowest daily value on record for the time of year. The eastern Weddell Sea alone contributes roughly 2.75×10^6 km^2 to the overall sea-ice deficit, but notable reductions in sea-ice extent and area are also in the Ross Sea (roughly 1×10^6 km^2) and the Cooperation Sea in East Antarctica.
In general, the sea-ice area is at record low values in the entire Antarctic and sea-ice extent is heading the same way (currently only second to 2016).

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Davis Station

Figure 2 shows a SAR scene of the Vestfold Hills and offshore. The fast-ice edge is marked by a red line. The recent movements of a large, tabular iceberg (a D-15B fragment) are indicated by coloured shapes (with corresponding dates).

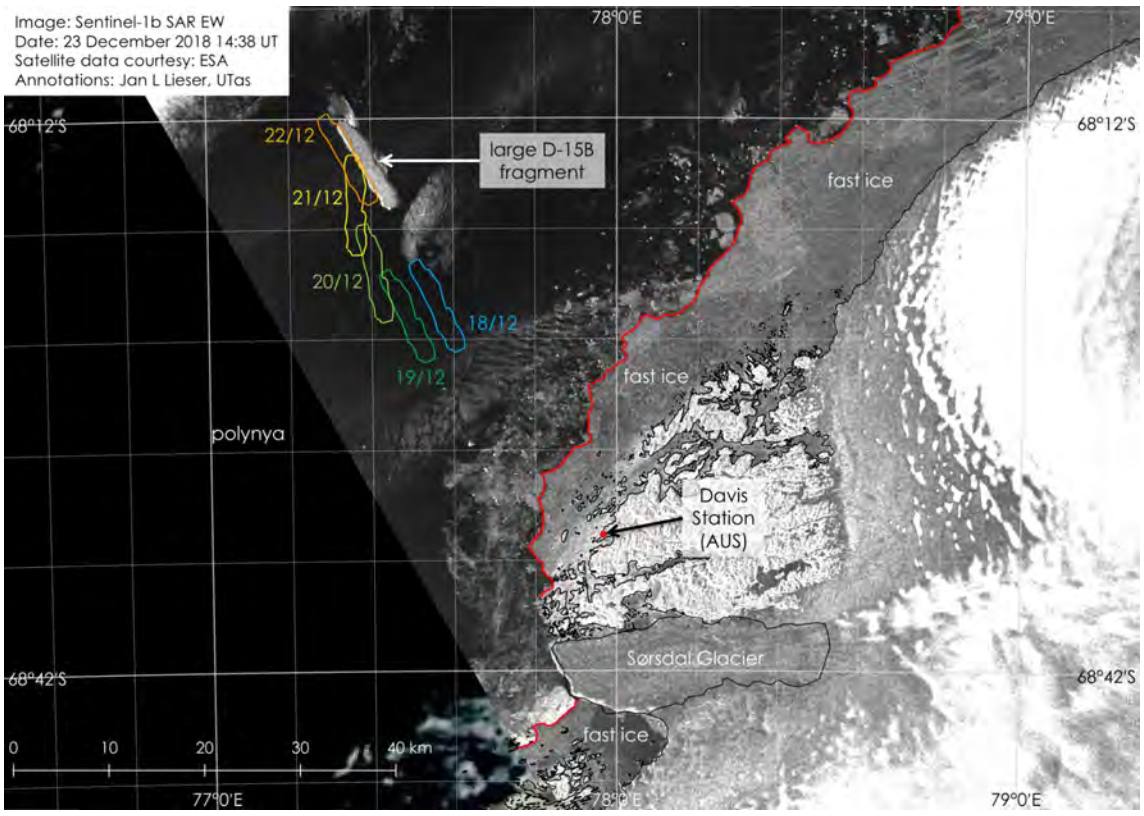

Figure 2: *Sentinel-1b SAR EW scene acquired on 23/12/2018 at 14:38 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired 23/12/2018 and provided by NASA.*

Fast ice continues to break away offshore and ex-fast ice is drifting generally southwestward along the coast. The fast-ice edge is currently roughly 6 km west of Davis Station.

Casey Station and Sabrina Coast

Figure 3 shows a visible scene of Law Dome and east of it. The green line indicates the median sea-ice extent for December.
North of Casey Station, the polynya is separated from the open ocean in the north only by a band of roughly 32 nautical miles (north-south extent) of decaying, first-year pack ice.

Figure 4 shows a high-resolution SAR scene of the northern part of the Moscow University Ice Shelf.
Since 19/12/2018 (see Sea Ice Report #51.4/2018), the fast-ice edge has not changed significantly off Henry Islands and Chick Island.

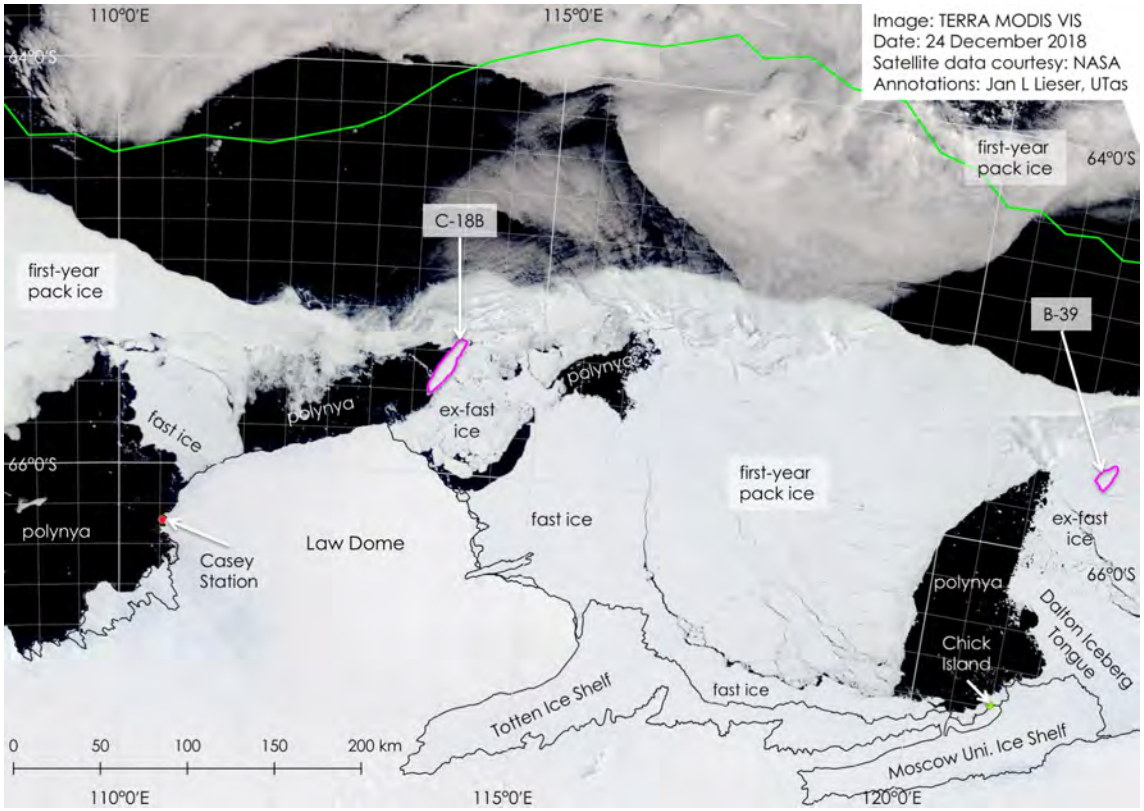

Figure 3: *TERRA MODIS VIS scene acquired on 24/12/2018 and provided by NASA.*

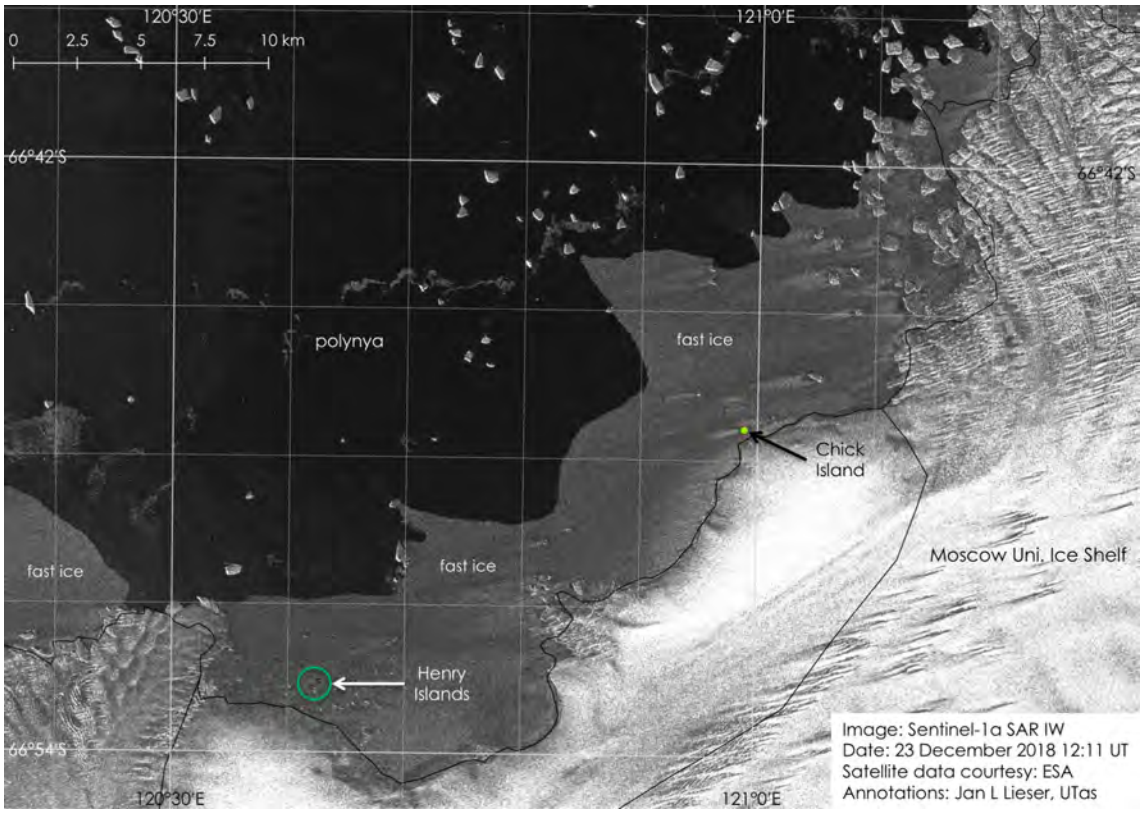

Figure 4: *Sentinel-1a SAR IW scene acquired on 23/12/2018 at 12:11 UT and provided by PolarView.*

D'Urville Sea

Figure 5 shows a SAR scene off Cape Denison/Commonwealth Bay. The fast-ice edge is marked by a red line. The locations of four large, tabular icebergs on 22/12/2018 at 10:40 UT (approximately 32 hours prior to the data shown in Figure 5) are marked by dashed, pink shapes.

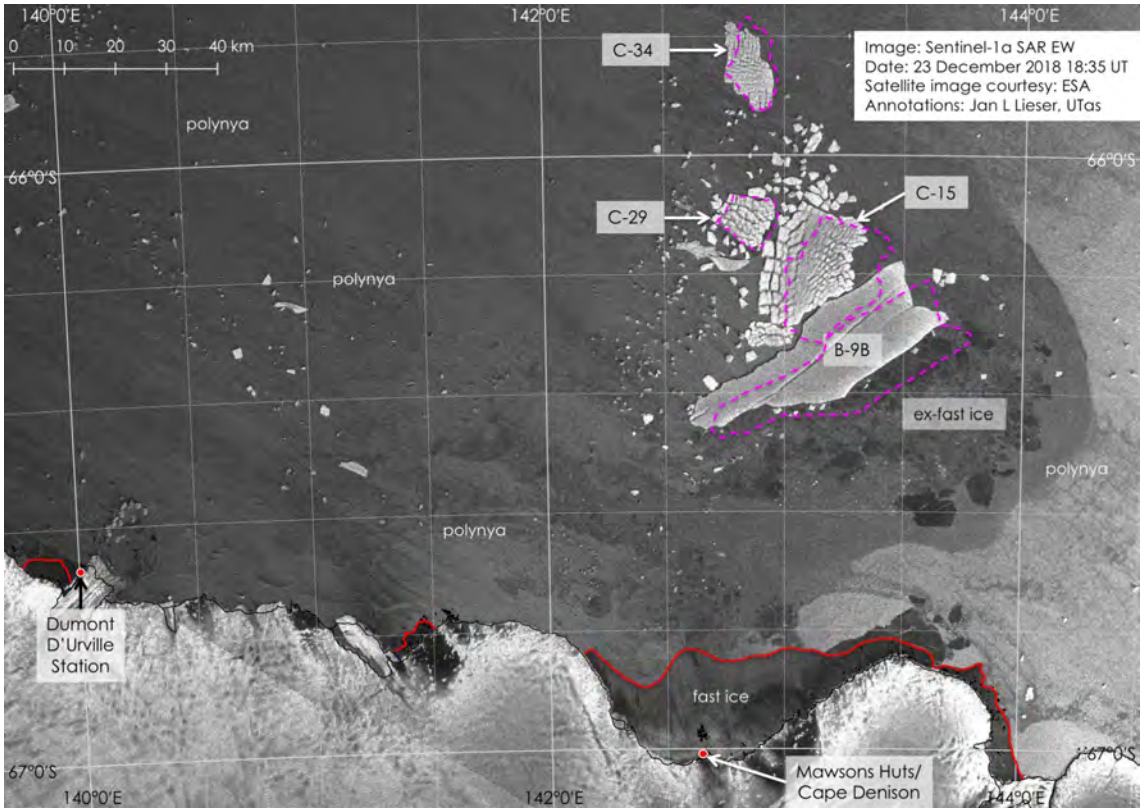

Figure 5: *Sentinel-1a SAR EW scene acquired on 23/12/2018 at 18:35 UT and provided by PolarView.*

All four icebergs have changed position to various degrees. Iceberg C-34 appears still grounded at its southern end, while the northern part of the iceberg moves east-westward back and forth. Icebergs C-15 and B-9B are moving closely together and have both travelled roughly 6 km in northwestward direction (in only 32 hours). Even iceberg C-29 has moved westward by about 1 km, but this appears to be likely only caused by the impact of iceberg C-15 (and iceberg B-9B) at its southeastern edge.

Sea Ice Report #52.2/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
27/12/2018

Mawson Station

Figure 1 shows a visible scene off Mawson Station. The dashed, red line shows the fast-ice edge on 24/12/2018. The red-white frame indicates the position of Figure 2.

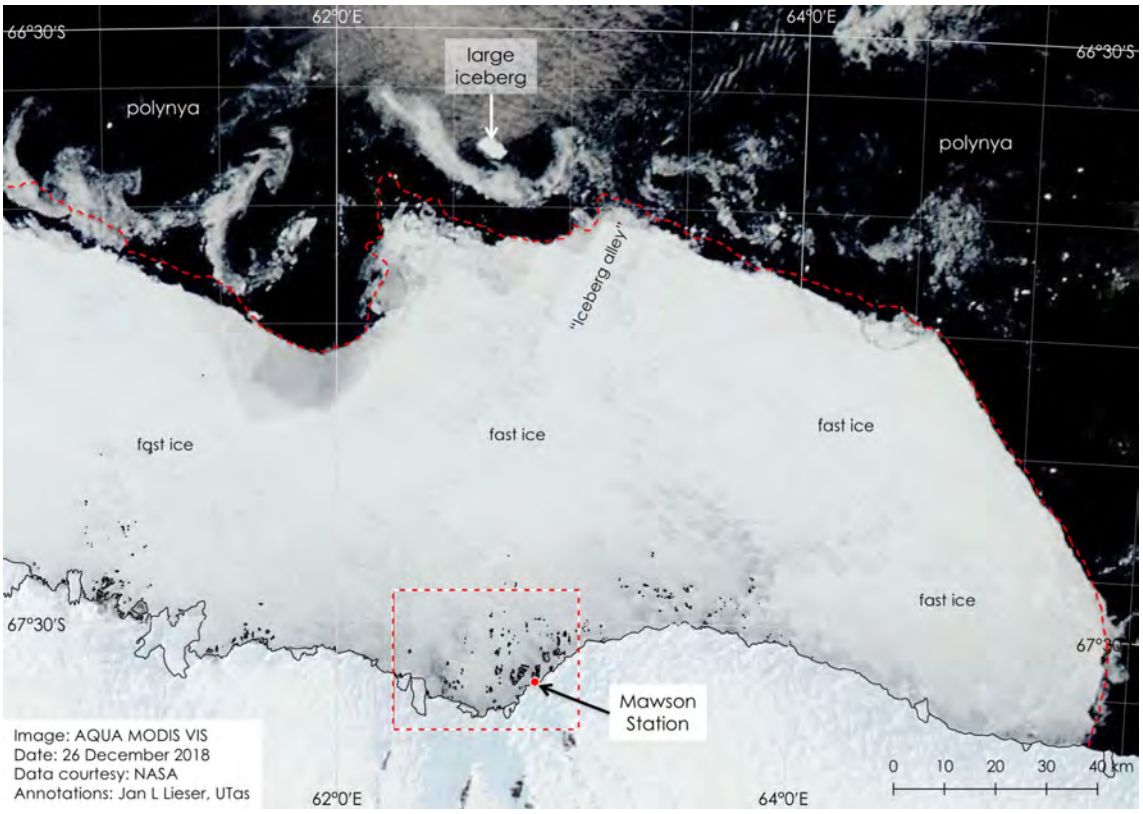

Figure 1: *AQUA MODIS VIS data acquired 26/12/2018 and provided by NASA.*

Off Mawson Coast, the fast-ice edge is starting to retreat towards the coast. Strips and patches of ex-fast ice can be seen north of the fast-ice edge. Also near-shore, the fast ice appears to deteriorate locally, which is highlighted by the high-resolution visible scene of Figure 2.

East of Forbes Glacier, the fast-ice surface appears with dark patches, which shows very thin ice where the dark ocean is shining through.

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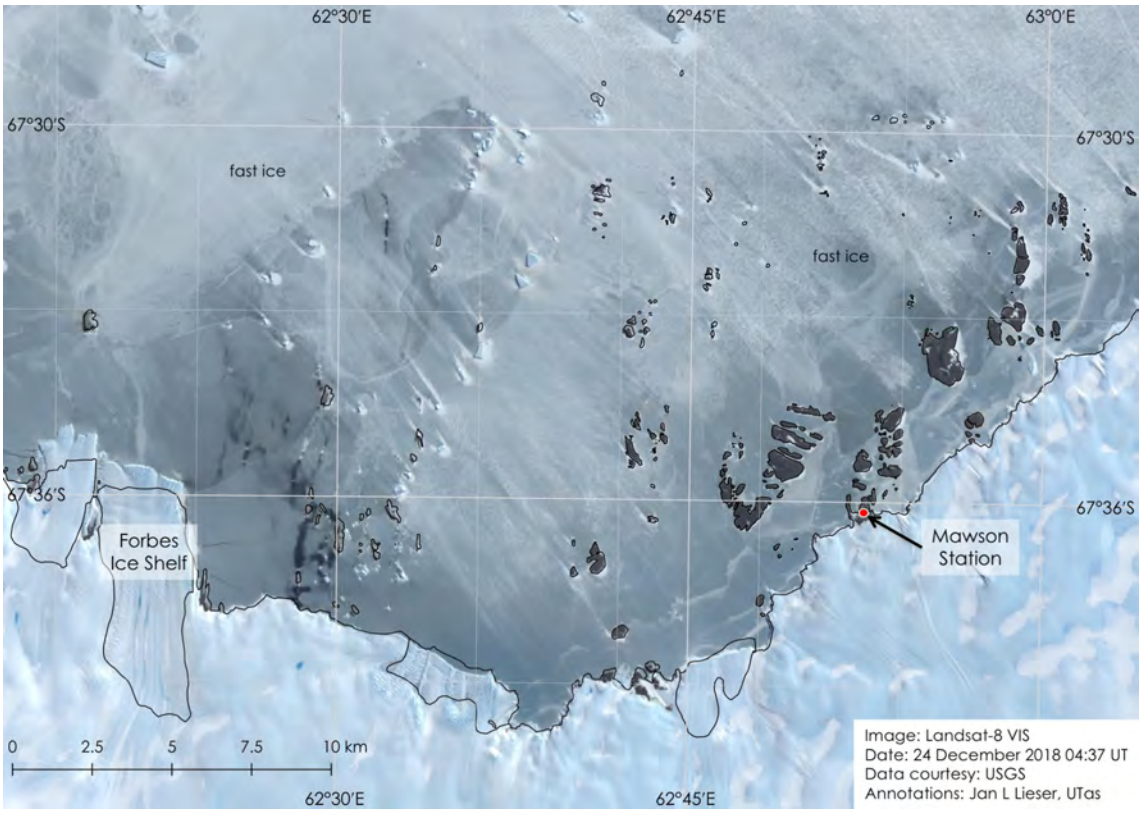

Figure 2: *Landsat-8 visible composite acquired 24/12/2018 at 04:37 UT and provided by USGS.*

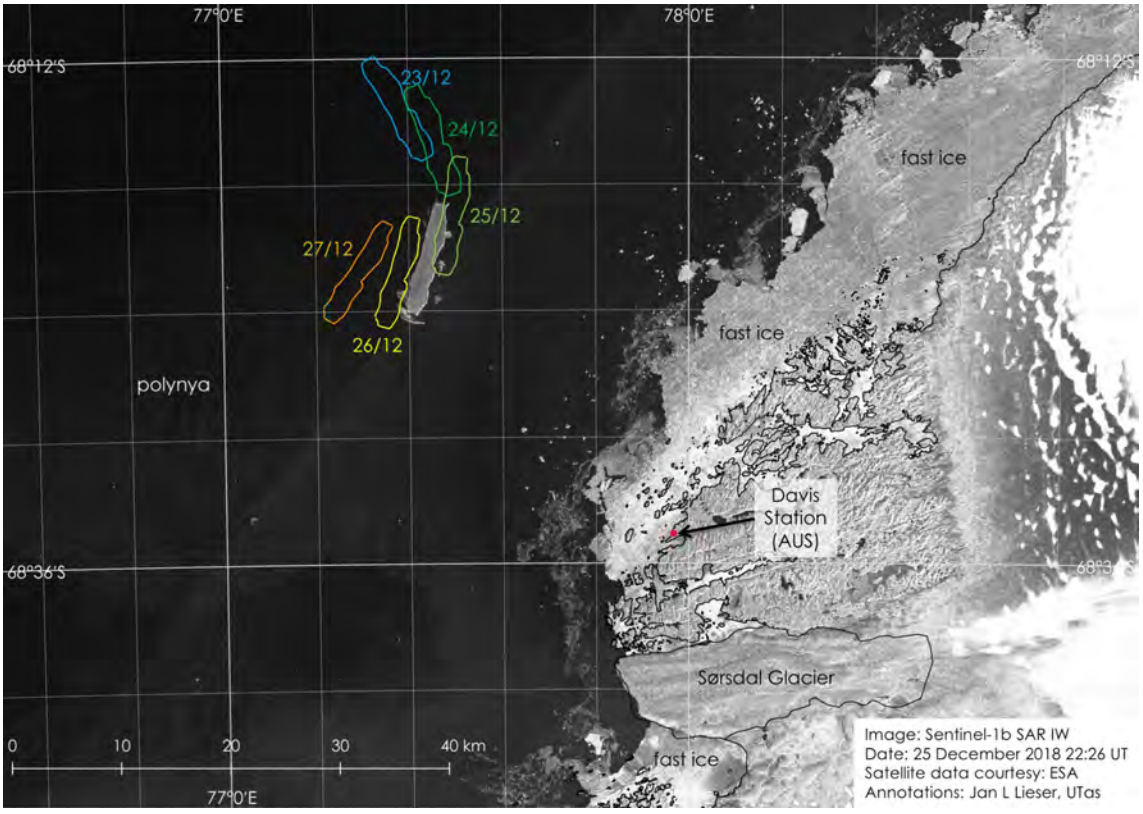

Figure 3: *Sentinel-1b SAR IW scene acquired on 25/12/2018 at 22:26 UT and provided by PolarView.*

Davis Station

Figure 3 shows a SAR scene of the Vestfold Hills and offshore. The recent movements (based on visible imagery) of a large, tabular iceberg (a D-15B fragment) are indicated by coloured shapes (with corresponding dates).

The large iceberg has completed a circular movement, which started at around 18/12/2018. The SAR scene shown in the figure was acquired in between the visible data acquisition and was chosen for illustration, as it highlights that the iceberg displays signs of instability at its sides, where patches of glacial-ice debris are scattered predominantly around the eastern and southern side of the berg.

Casey Station

Figure 4 shows a SAR scene of the sea ice north of Casey Station. The recent cruise track of RSV *Aurora Australis* is marked by the orange line. The fast-ice edge is indicated by a red outline.

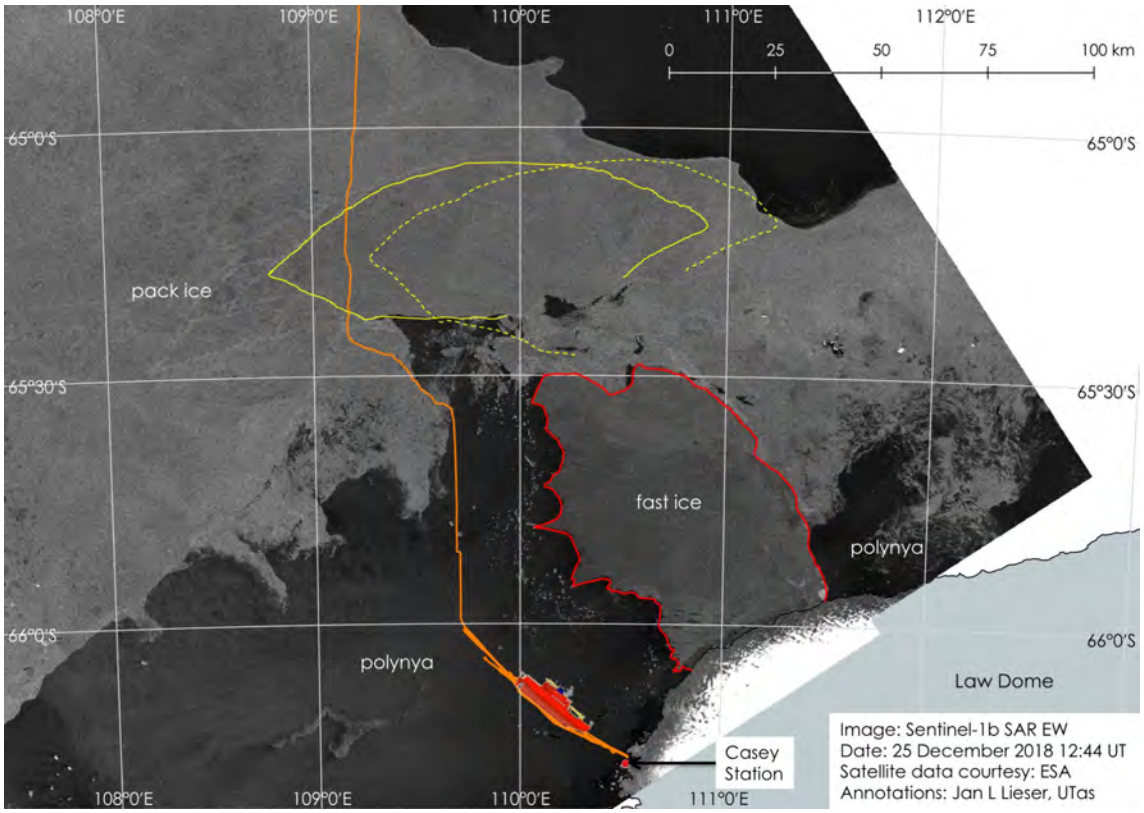

Figure 4: *Sentinel-1b SAR EW scene acquired on 25/12/2018 at 12:44 UT and provided by PolarView.*

Since 23/12/2018, a rather homogenous patch of sea ice is drifting westward, which originated from north of the fast ice off Law Dome. Its rough outline on 23/12/2018 is marked by the dashed, yellow shape. Two days later, it can be identified again in the SAR data (as marked by the solid, yellow shape) and has travelled approximately 10 nautical miles.

Figure 5 shows a high-resolution SAR scene off Casey Station. Fast ice in sheltered bays is marked by red lines.

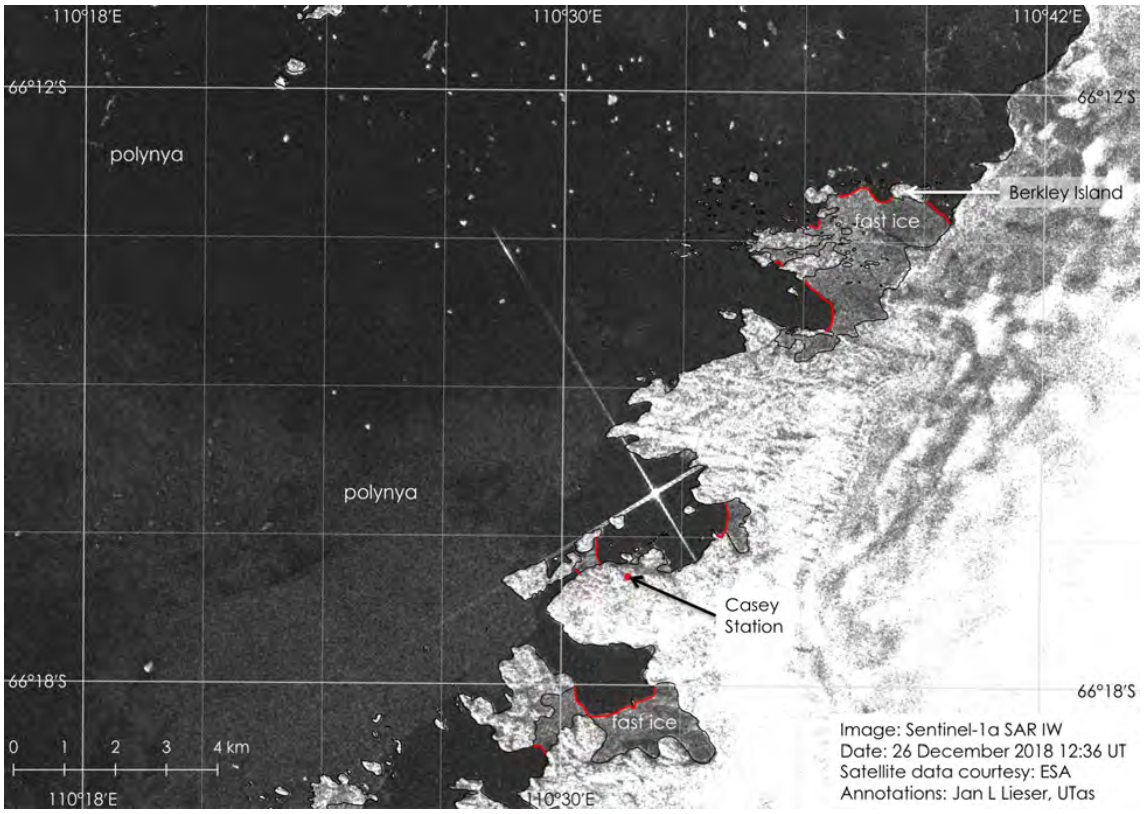

Figure 5: *Sentinel-1b SAR IW scene acquired on 26/12/2018 at 12:36 UT and provided by PolarView.*

In Newcomb Bay (off Casey Station), the star-shaped signature is caused by RSV *Aurora Australis* and a result of a 'perfect reflector' hit at an ideal angle (with respect to the space-borne SAR instrument) at the time of the data acquisition.

Sea Ice Report #52.3/2018

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
30/12/2018

Casey Station

Figure 1 shows a VIIRS Day-Night-Band image of the sea ice north of Casey Station. The scene is slightly affected by clouds. The recent cruise track of RSV *Aurora Australis* (since the vessel left the station and up until 30/12/2018 00:00 UT) is marked by the orange line. The fast-ice edge off Law Dome is indicated by a red outline. A green line marks the sea-ice edge based on SAR data acquired on 28/12/2018 at 12:20 UT and a cyan line marks the sea-ice edge based on the DNB data shown in the figure.

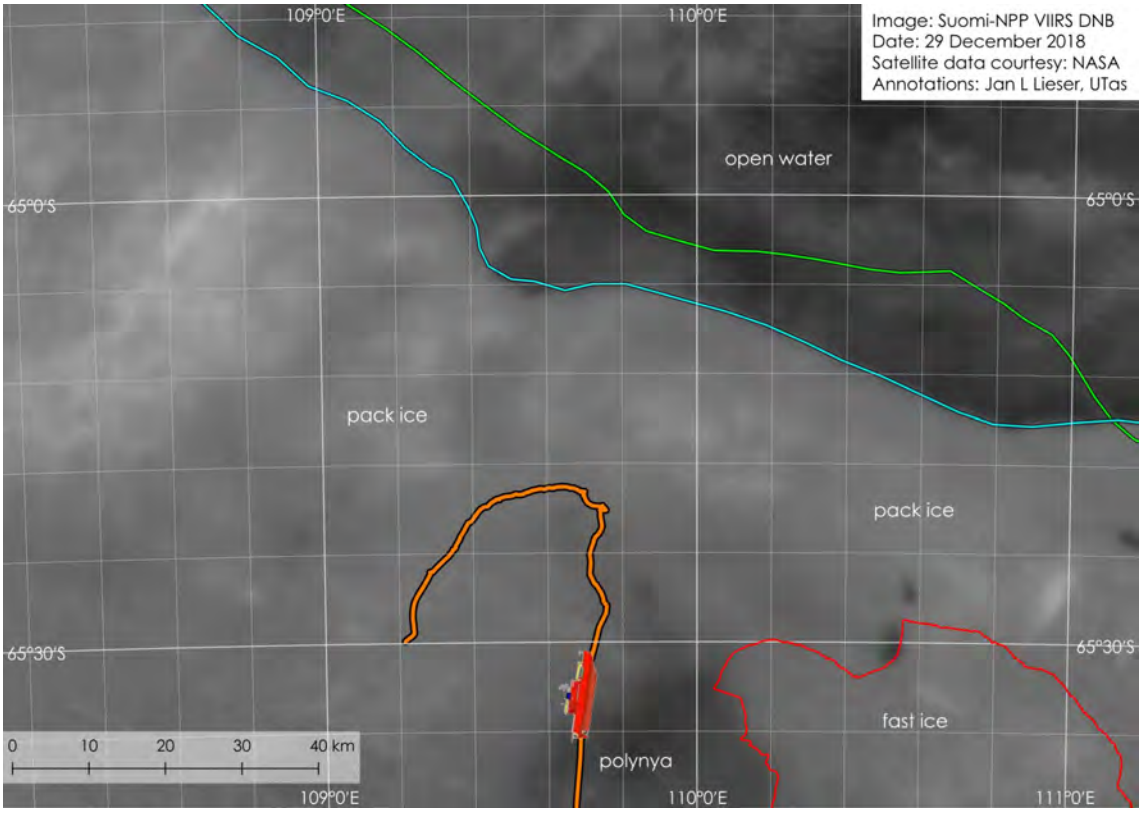

Figure 1: *Suomi-NPP VIIRS Day-Night-Band scene acquired on 29/12/2018 and provided by NASA.*

During the past approximately 18 to 24 hours, the sea-ice edge has been pushed southwestward and compacted the sea ice south of it.

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Figure 2 shows the same VIIRS-DNB data as of Figure 1 and additionally an overlay of SAR data acquired roughly 24-hours after the SAR data, on which Friday's sea-ice edge is based (the green line).

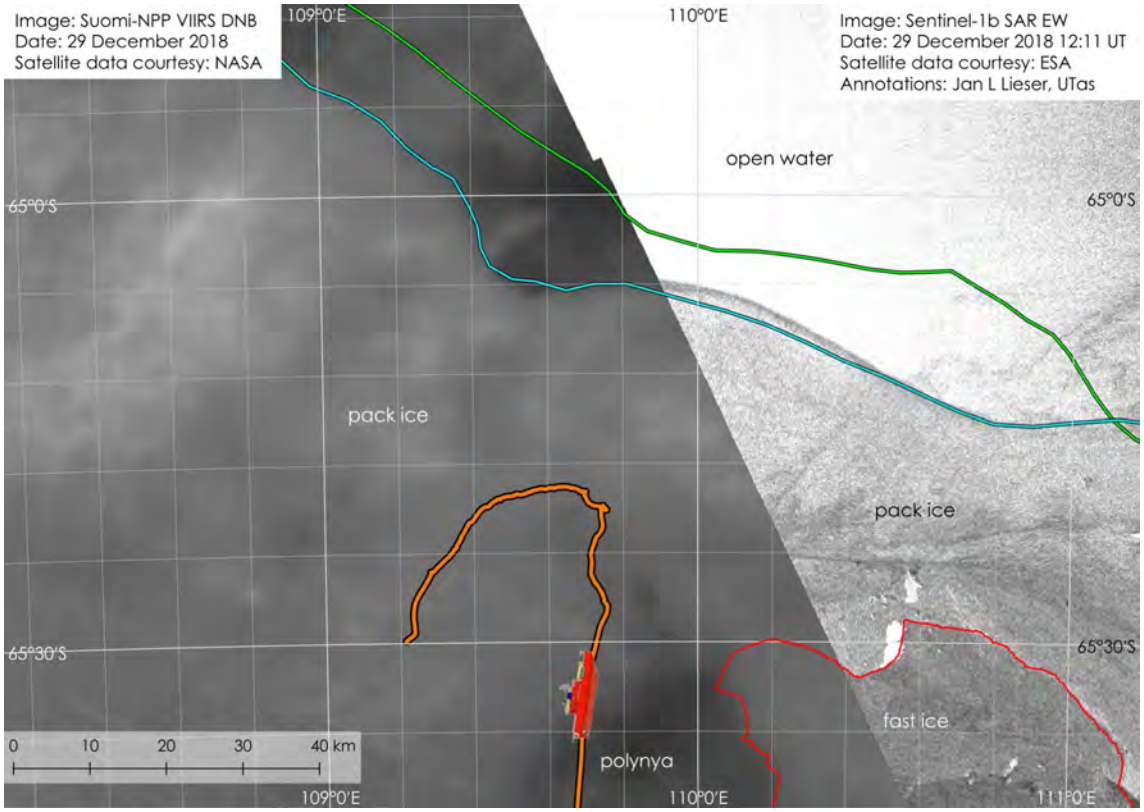

Figure 2: *As Figure1 with an overlay of Sentinel-1b SAR EW data acquired on 29/12/2018 at 12:11 UT and provided by PolarView.*

Only east of 110° 30' E, the sea-ice edge shows thin strips and patches reaching northward, the western sea-ice edge is very well-defined and compacted. This compaction was caused by the strong easterly winds prevailing during the past 24 to 36 hours and can be expected to ease when the wind direction changes to southwest in the next 24 to 36 hours.

Figure 3 shows the same geographical frame as Figure 1 (with the same annotations), but visible data acquired on 30/12/2018.

Even though the entire scene is affected by more or less opaque clouds, a westward shift of the sea ice by roughly 2.5 nautical miles can be seen along 65° S at 109° 24' E.

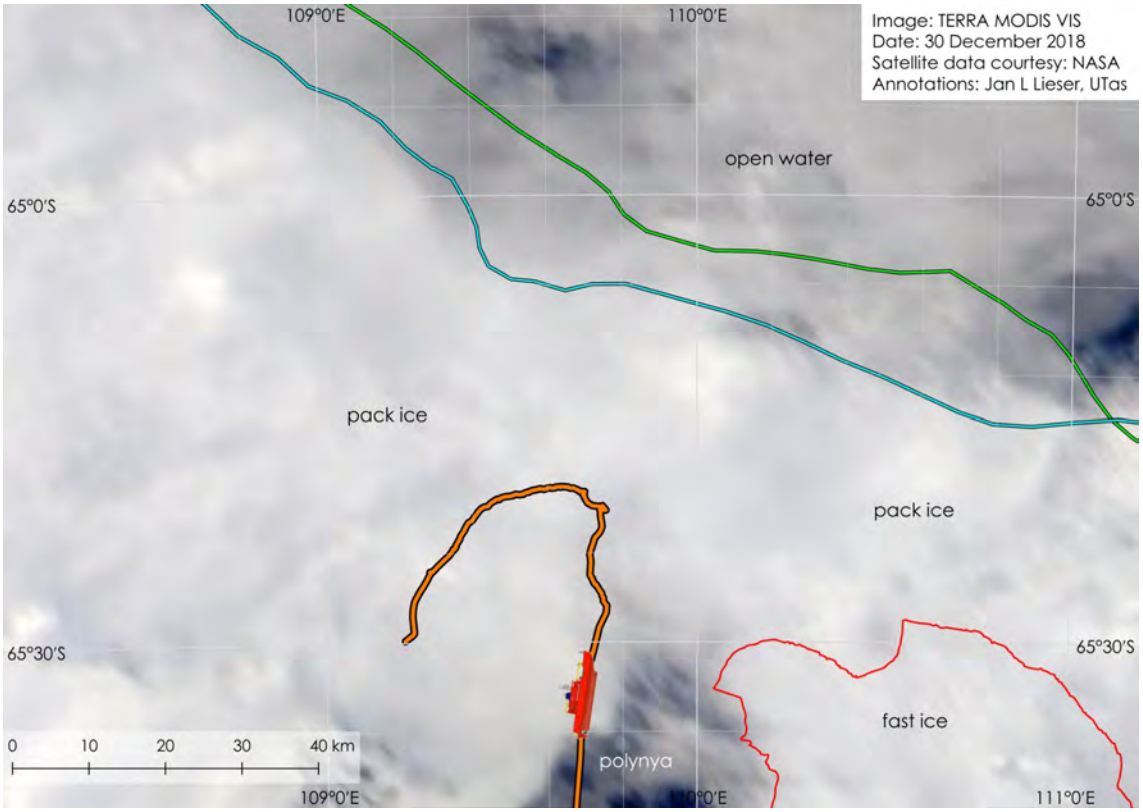

Figure 3: *TERRA MODIS VIS data acquired on 30/12/2018 and provided by NASA.*

Sea Ice Report #01.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
01/01/2019

Casey Station

Figure 1 shows a very-high-resolution (10 m horizontal resolution) visible scene of the sea ice north of Casey Station. The scene is cloud free. The recent cruise track of RSV *Aurora Australis* (since the vessel left the station and up until 31/12/2018 22:00 UT) is marked by the orange line. Some large icebergs are marked by pink circles.

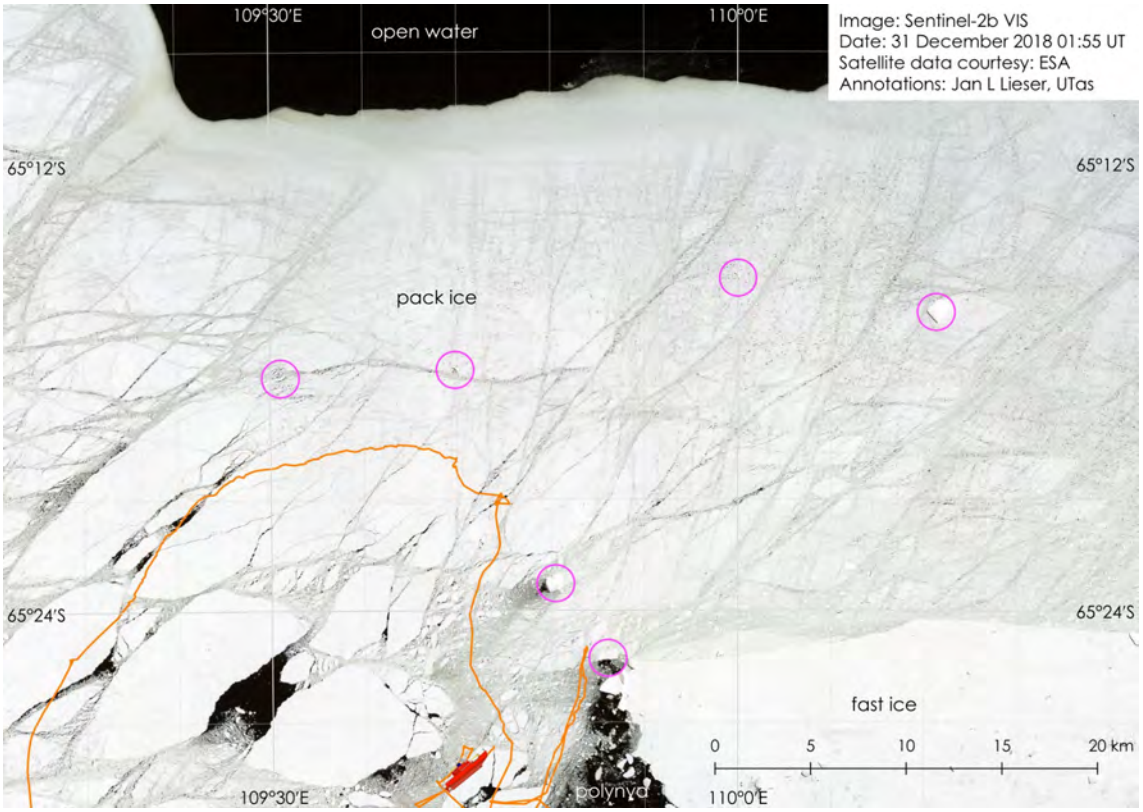

Figure 1: *Sentinel-2b visible composite data acquired on 31/12/2018 at 01:55 UT and provided by USGS.*

The northern sea-ice edge remains well defined. The pack-ice zone shows many southwest-northeast oriented kinematic features, which are the result of the recent compaction. Where these features appear dark in the visible data, the ocean surface shines through.

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Figure 2 shows a VIIRS Day-Night-Band image of the sea ice north of Casey Station. The scene is slightly affected by high clouds. The recent cruise track of RSV *Aurora Australis* (since the vessel left the station and up until 31/12/2018 23:00 UT) is marked by the orange line. A cyan line marks the sea-ice edge based on AQUA MODIS visible data acquired on 31/12/2018 (at least 12 hours before the Day-Night-Band data).

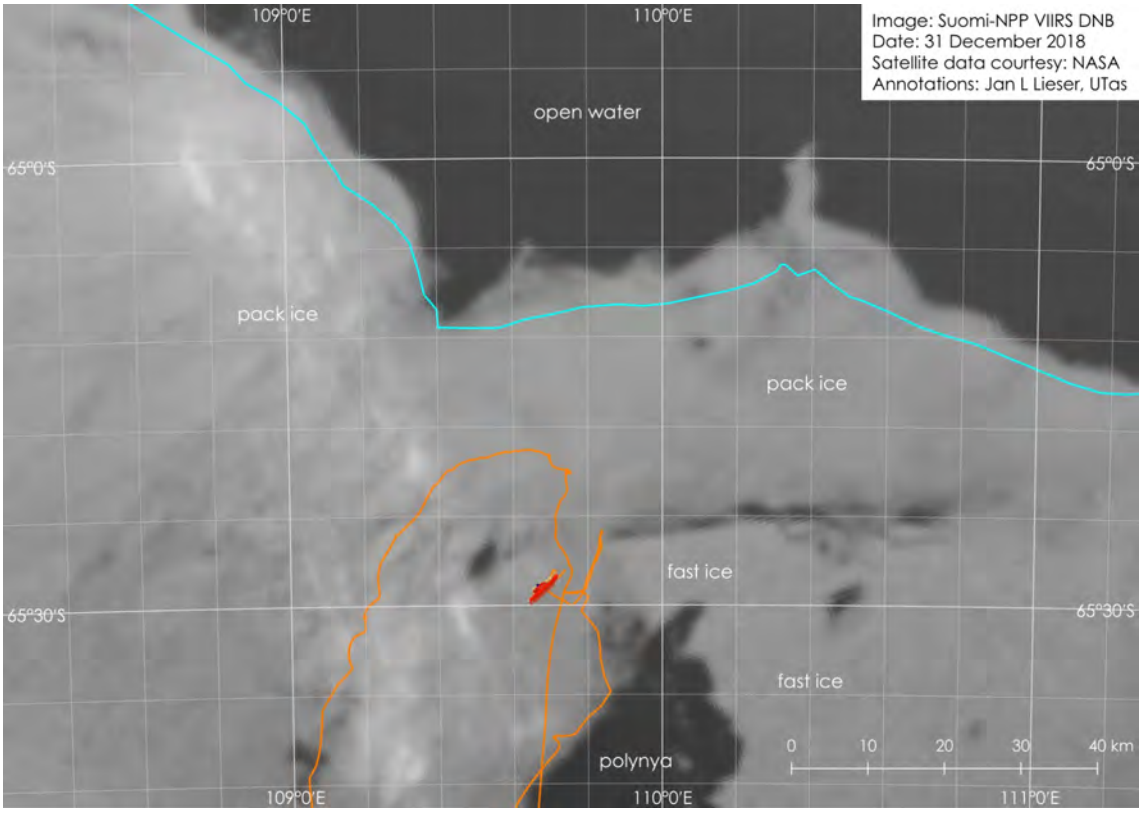

Figure 2: *Suomi-NPP VIIRS Day-Night-Band scene acquired on 31/12/2018 and provided by NASA.*

This data of Figure 2 have been acquired after the data shown in Figure 1. Recent wind conditions have allowed the sea-ice edge to relax slightly, as it shows not such a well-defined line anymore.

Sea Ice Report #01.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
01/01/2019

Mawson Station

Figure 1 shows a SAR scene off Mawson Station. The red line marks the fast-ice edge.

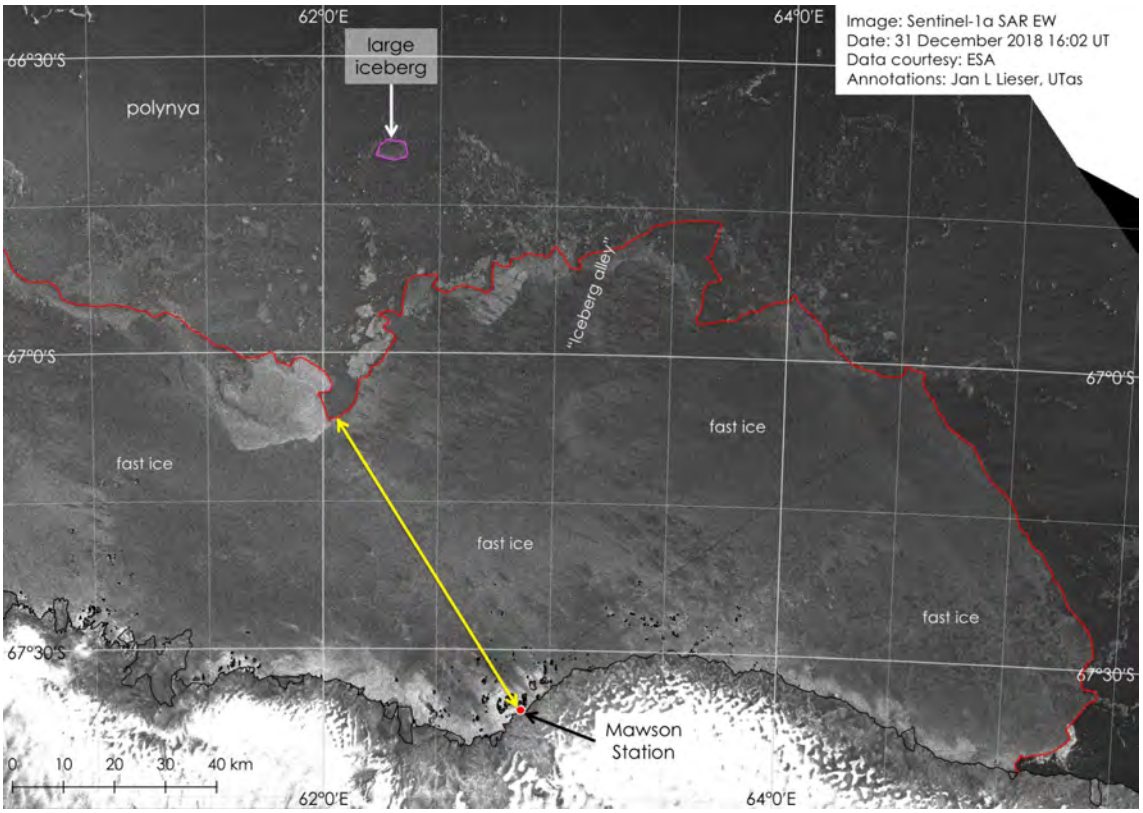

Figure 1: *Sentinel-1a SAR EW data acquired 31/12/2018 at 16:02 UT and provided by PolarView.*

Off Mawson Coast, the fast-ice edge shows further signs of deterioration and retreat towards the coast. Strips and patches of ex-fast ice can be seen north of the fast-ice edge.

The shortest distance to open water of the so-called 'northwest polynya' is roughly 36.5 nautical miles (yellow arrow).

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D'Urville Sea

Figure 2 shows a SAR scene off Cape Denison/Commonwealth Bay. The fast-ice edge is marked by a red line. The locations of four large, tabular icebergs on 23/12/2018 at 18:35 UT (see Sea Ice Report #52.1/2018 for reference) are marked by dashed, pink shapes.

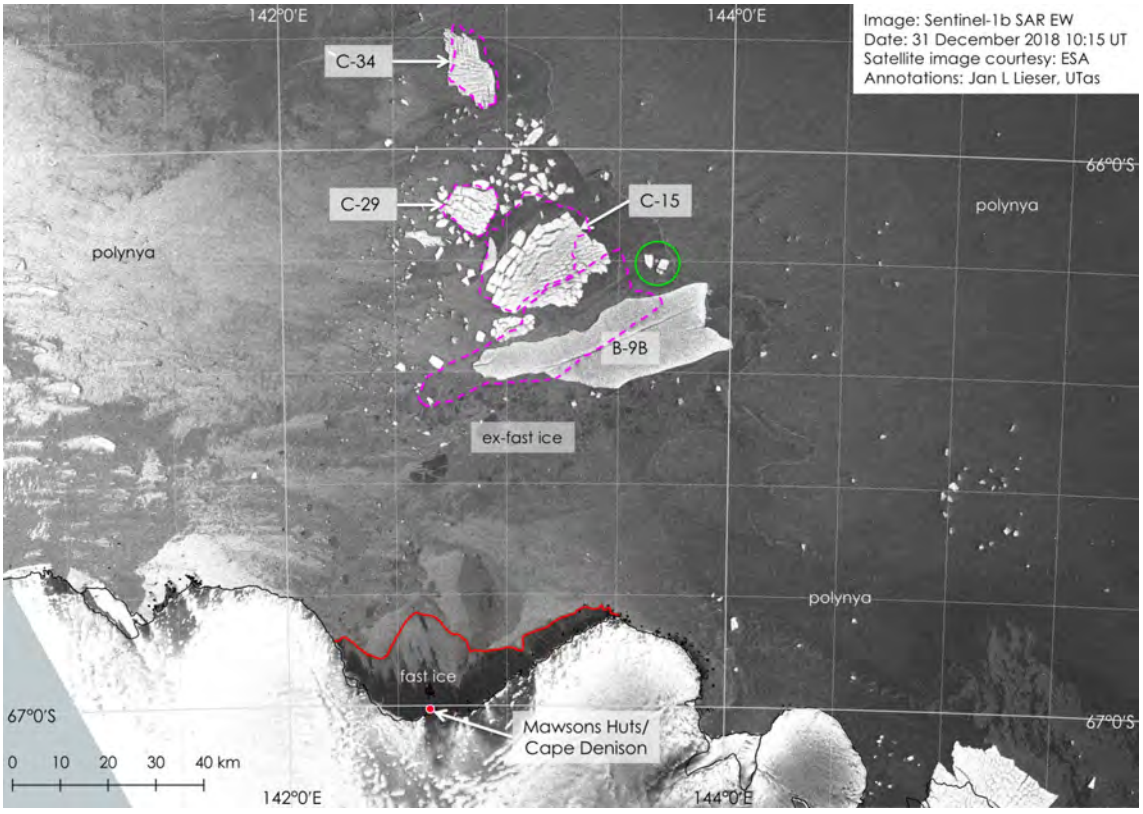

Figure 2: *Sentinel-1b SAR EW scene acquired on 31/12/2018 at 10:40 UT and provided by PolarView.*

Three of the four icebergs have changed position to various degrees. Iceberg C-34 remains grounded at its southern end, while the northern part of the iceberg moves east-westward back and forth. Icebergs C-15 and B-9B have been drifting eastward, iceberg B-9B more than 15 km and has now moved around two smaller, grounded icebergs (marked with a green circle) that have repeatedly held iceberg B-9B local. Iceberg C-29 has not moved since 23/12/2018.

Off Cape Denison, fast ice continues to break up.

Sea Ice Report #01.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
01/01/2019

Casey Station

Figure 1 shows a visible scene of the sea ice north of Casey Station. The scene is affected by clouds in the west. The current position of RSV *Aurora Australis* (01/01/2019 05:00 UT) is marked by the orange dot. Some of the large icebergs that were identified in Figure 1 of Sea Ice Report #01.1/2019 are marked by pink circles. The blue line indicates the sea-ice edge based on MODIS VIS data acquired 31/12/2018, the green line gives the sea-ice edge based on the data of Figure 2 of Sea Ice Report #01.1/2019. Some sea-ice floe aggregates are marked by blue shapes (dashed based on yesterday's MODIS data).

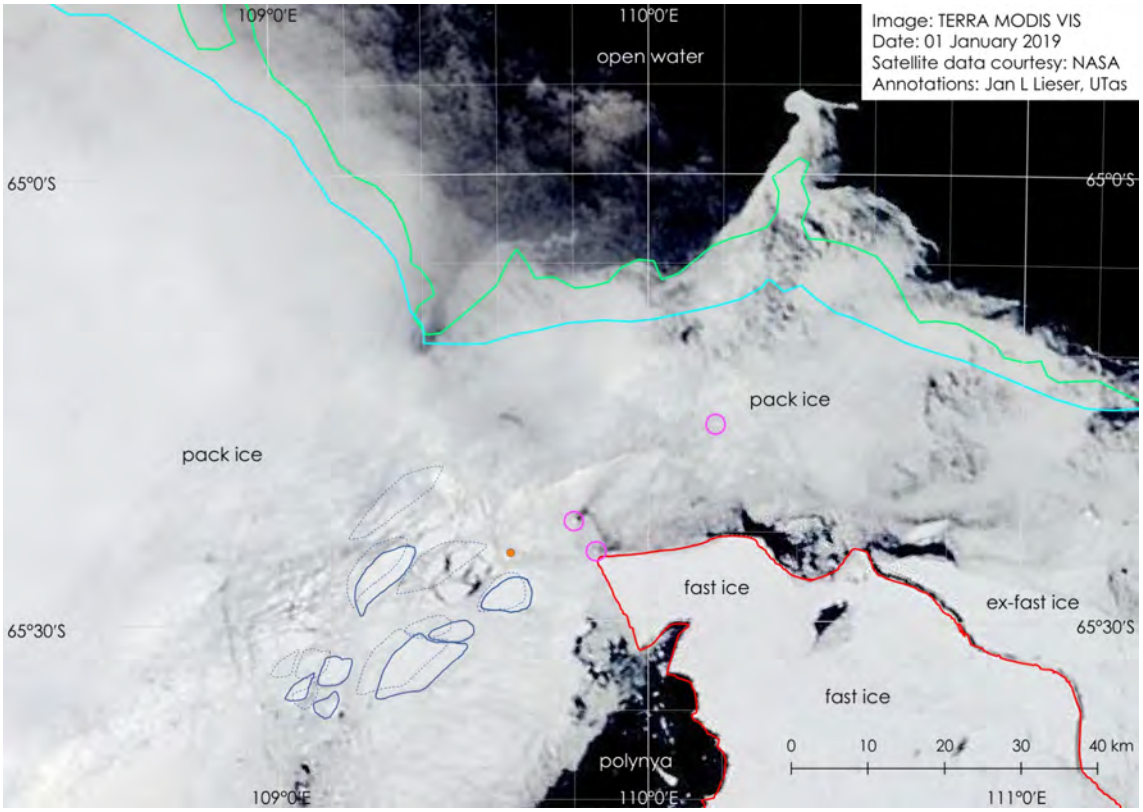

Figure 1: *TERRA MODIS visible data acquired on 01/01/2019 and provided by NASA.*

The change in shape of the northern sea-ice edge can be seen.

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Some large sea-ice floes are identified by blue shapes have drifted predominantly southeastward. Some of the dashed shapes have no corresponding solid shapes where the aggregated sea-ice floes have broken into smaller pieces.

North of roughly 65° 15' S, the sea-ice pack of the region had a more northeasterly drift during the past 24 hours, while the pack ice further south drifted more east-southeast.

Sea Ice Report #01.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
02/01/2019

Davis Station

Figure 1 shows a high-resolution SAR scene of the Vestfold Hills and offshore. The recent movements (based on visible imagery) of a large, tabular iceberg (a D-15B fragment) are indicated by coloured shapes (with corresponding dates).

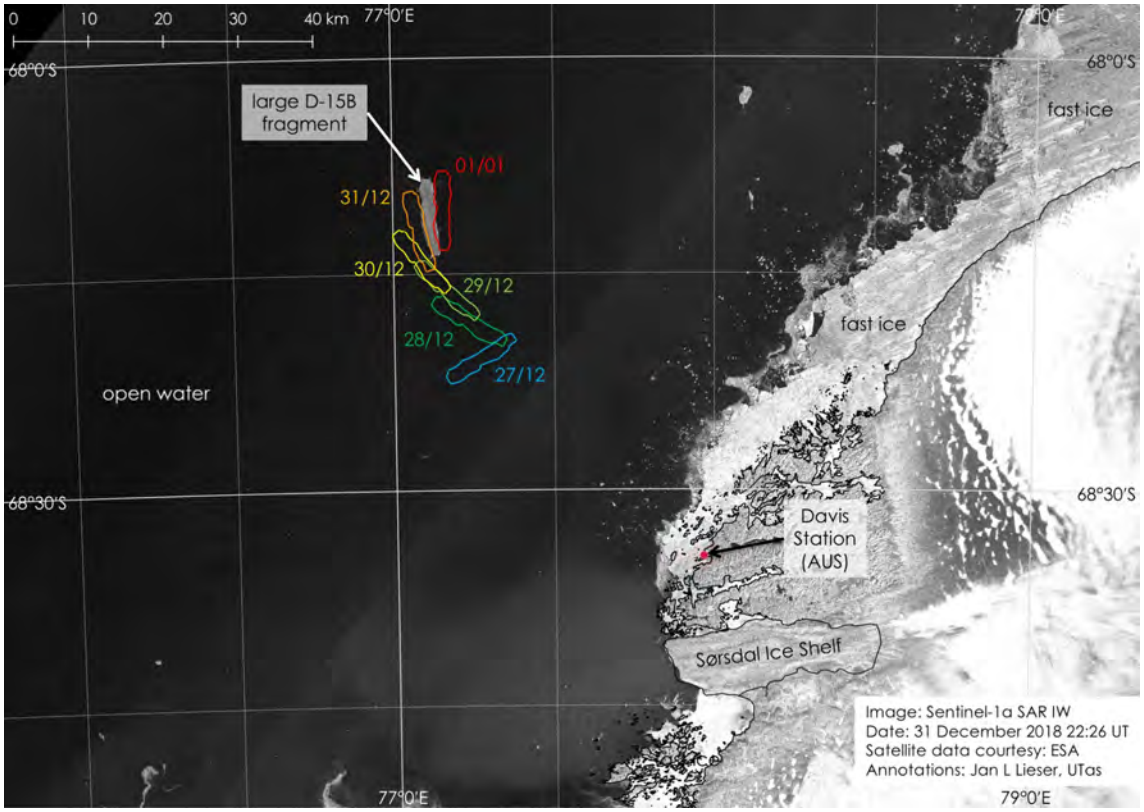

Figure 1: *Sentinel-1a SAR IW scene acquired on 31/12/2018 at 22:26 UT and provided by PolarView.*

The large iceberg has started a second circular movement. The SAR scene shown in the figure was acquired in between the visible data acquisition and was chosen for illustration.
Off the Vestfold Hills (and to the north and south of it), fast ice continues to break up. The front of the Sørsdal Ice Shelf is free of fast ice with only minimal ice debris floating freely offshore.

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Sea Ice Report #01.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
03/01/2019

Ross Sea

Figure 1 shows a sea-ice concentration chart of the western Ross Sea with the sea-ice edge on 30/12/2018, 31/12/2018, 01/01/2019 and 02/01/2019 marked as a red, orange, yellow and green line, respectively. The white and cyan lines indicate the median sea-ice extent for December and January, respectively, in the region.

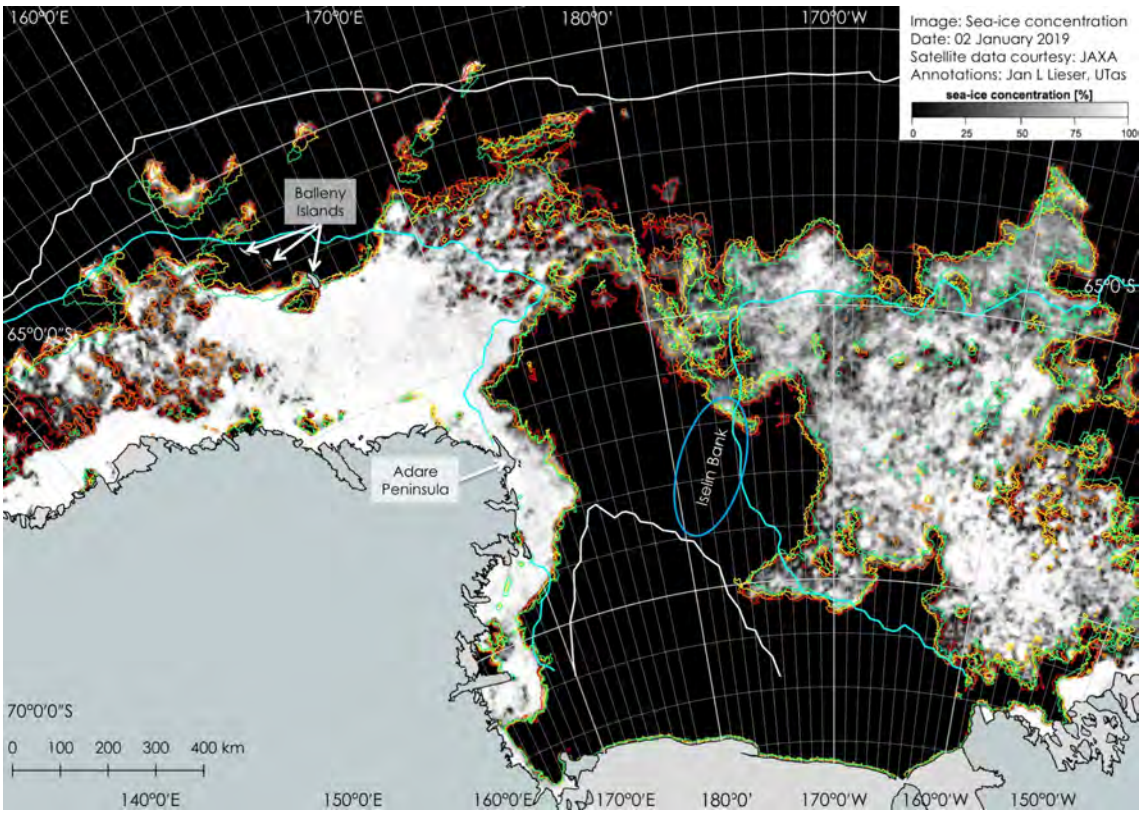

Figure 1: *Sea-ice concentration data acquired 02/01/2019 and provided by ICDC/Universität Hamburg.*

In the Ross Sea, sea ice shows a consistent pattern of retreat from the north and the south (off the Ross Ice Shelf, where the polynya continues to grow). Between the Balleny Islands and Adare Peninsula, a large patch of high-concentration sea ice still remains.

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Sea Ice Report #01.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
03/01/2019

D'Urville Sea and Ross Sea

Figure 1 shows a sea-ice concentration chart of the eastern D'Urville Sea and western Ross Sea. Additionally, the sea-ice edge on 30/12/2018, 31/12/2018, 01/01/2019 and 02/01/2019 is marked as a red, orange, yellow and green line, respectively. The white and cyan lines indicate the median sea-ice extent for December and January, respectively, in the region.

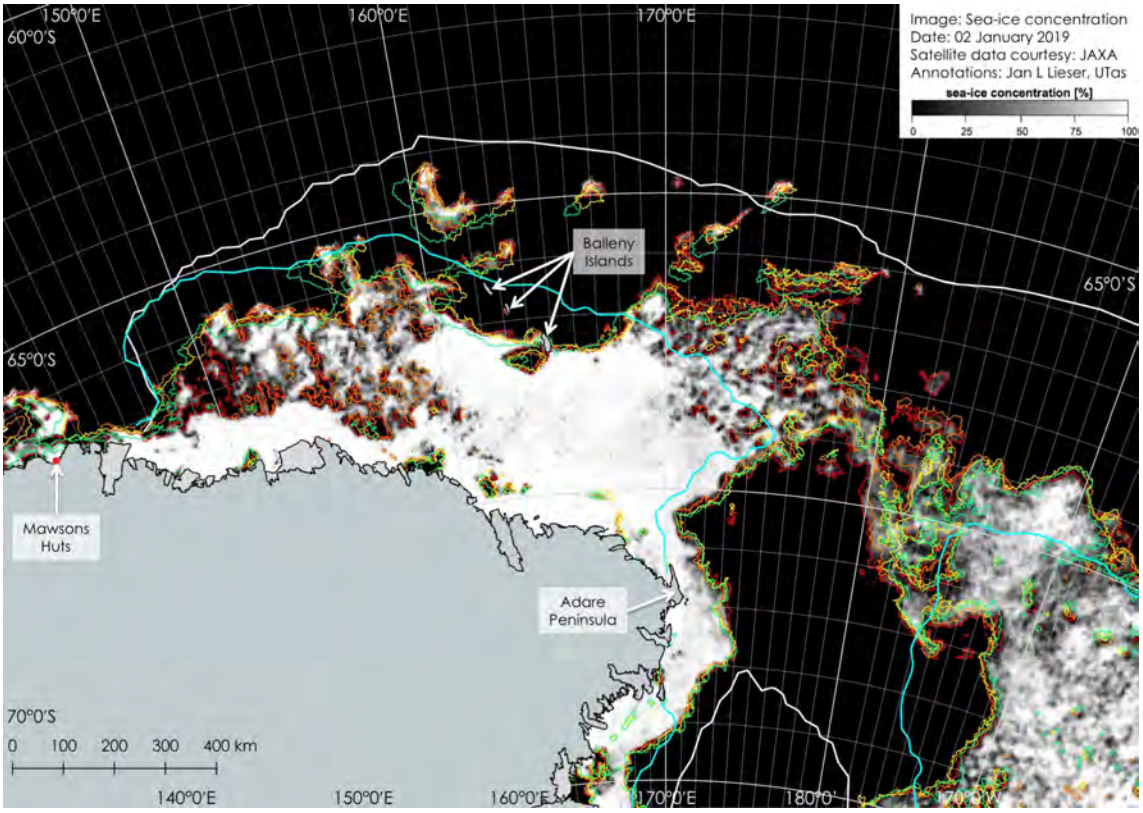

Figure 1: *Sea-ice concentration data acquired 02/01/2019 and provided by ICDC/Universität Hamburg.*

In eastern D'Urville Sea, sea ice shows advanced patterns of retreat, while in the western Ross Sea, between the Balleny Islands and Adare Peninsula, a large patch of high-concentration sea ice still remains.

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Sea Ice Report #01.7/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/01/2019

D'Urville Sea

Figure 1 shows a SAR scene of the coastal D'Urville Sea. The fast-ice edge is marked by a red line. The locations of four large, tabular icebergs on 03/01/2019 at 10:40 UT (approximately 8 hours prior to the data shown in Figure 1) are marked by dashed, pink shapes.

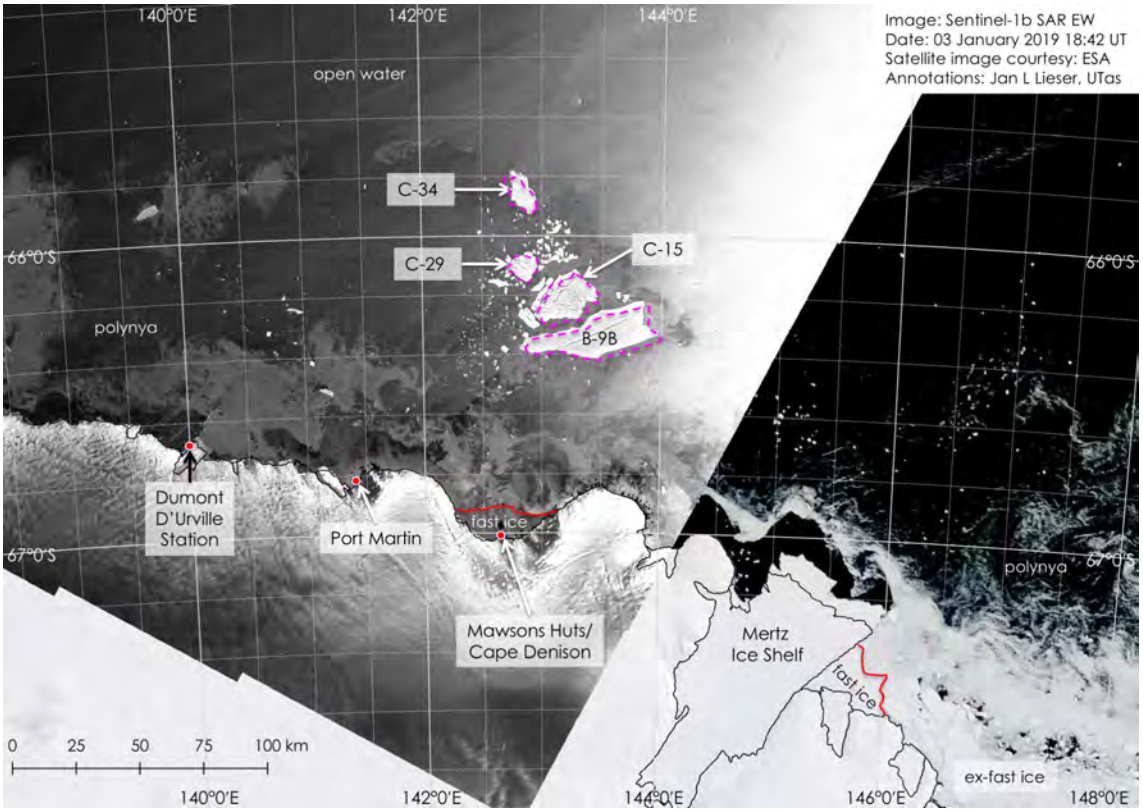

Figure 1: *Sentinel-1b SAR EW scene acquired on 03/01/2019 at 18:42 UT and provided by PolarView; complemented by TERRA MODIS VIS data acquired 03/01/2019 and provided by NASA.*

Three of the four icebergs have changed position to various degrees. Iceberg C-34 remains grounded at its southern end, while the northern part of the iceberg moves east-westward back and forth. Icebergs C-15 and B-9B have both drifted just under 3 km in a northwestward direction (in only 8 hours). Iceberg C-29 has not moved. Offshore, drifting sea ice consists predominantly of deteriorating ex-fast ice.

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Sea Ice Report #02.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
07/01/2019

D'Urville Sea

Figure 1 shows a visible and SAR composite of the coastal D'Urville Sea. The orange line indicates the recent track of OPV *l'Astrolabe* in the region (up until 06/01/2019 22:00 UT, off Port Martin). The fast-ice edge is marked by a red line. The locations of four large, tabular icebergs on 03/01/2019 at 18:43 UT are marked by dashed, pink shapes.

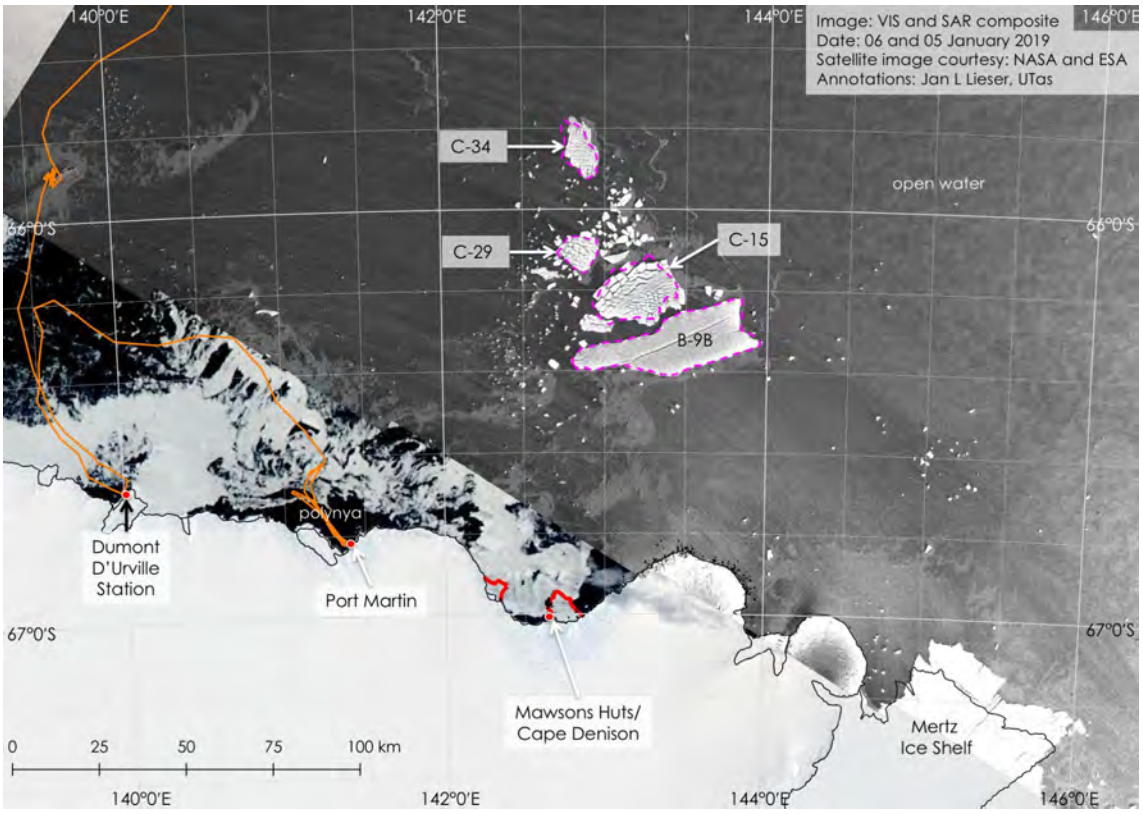

Figure 1: *AQUA MODIS VIS data acquired 06/01/2019 and provided by NASA; overlay of Sentinel-1b SAR EW scene acquired on 05/01/2019 at 18:26 UT and provided by PolarView.*

Between Dumont D'Urville Station and Cape Denison, drifting sea ice consists predominantly of deteriorating ex-fast ice. Off Cape Denison, only very little fast ice remains shorefast. Overall, the four, named icebergs have not changed position significantly during the past three days

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Sea Ice Report #02.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
07/01/2019

Mawson Station

Figure 1 shows a visible scene off Mawson Coast. Off Cape Darnley, the fast-ice edge on 31/12/2018 is marked by a dashed, red outline.

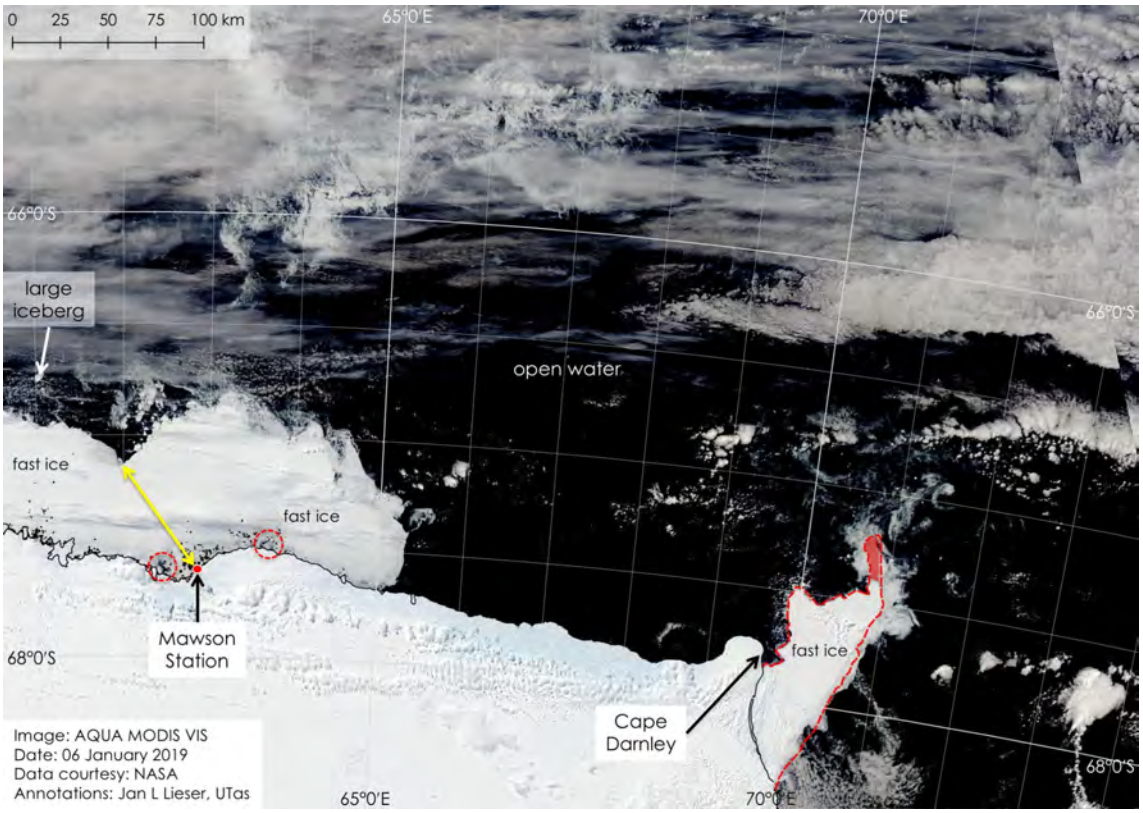

Figure 1: *AQUA MODIS VIS scene acquired on 06/01/2019 and provided by NASA.*

Off Mawson Station, the fast-ice edge is retreating slowly and the shortest distance to the open water of the so-called 'northwest polynya' is roughly 36 nautical miles (yellow arrow).

Nearshore fast ice shows also signs of advanced deterioration (marked by dashed, red circles). Off Cape Darnley, fast ice is also breaking up; since 31/12/2018, the northern tip of the fast ice has disintegrated (red shaped) and fast-ice debris remains local.

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Davis Station

Figure 2 shows a high-resolution SAR scene of the Vestfold Hills and offshore. The recent movements (based on visible imagery) of a large, tabular iceberg (a D-15B fragment) are indicated by coloured shapes (with corresponding dates).

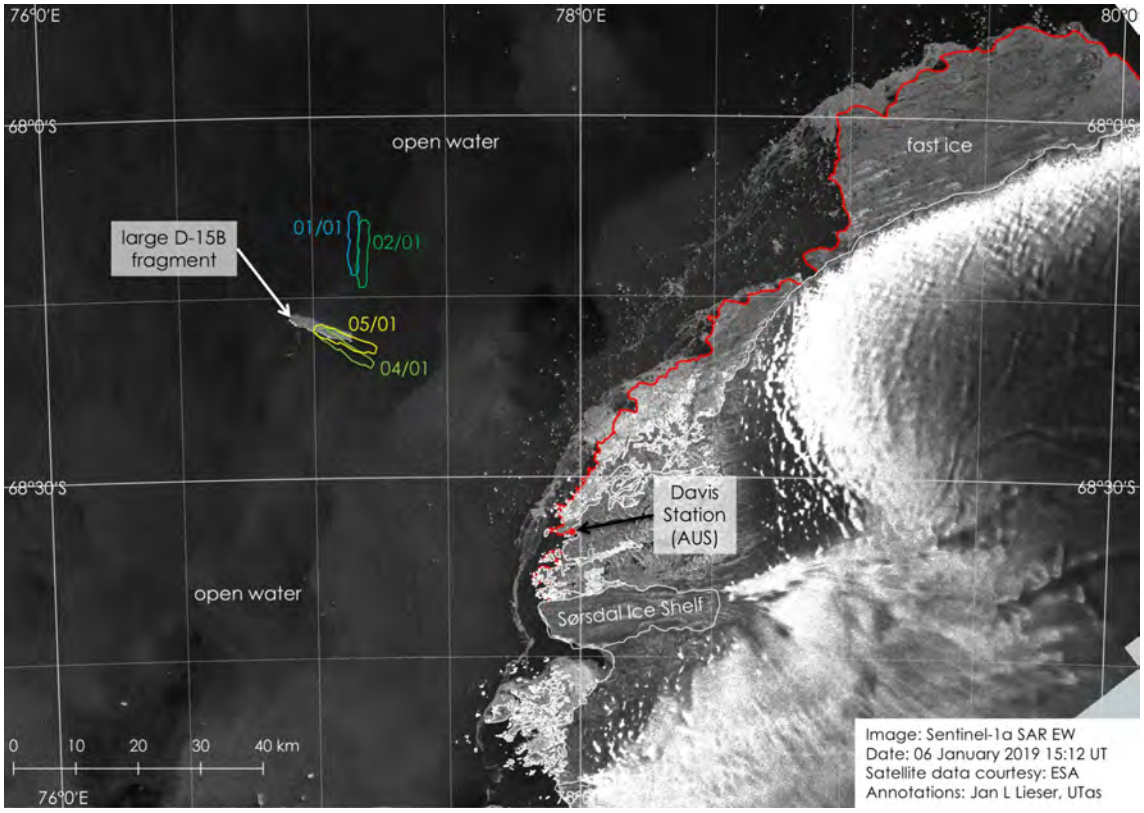

Figure 2: *Sentinel-1a SAR EW scene acquired on 06/01/2019 at 15:12 UT and provided by PolarView.*

The large iceberg has apparently completed a second circular movement locally.

Off the Vestfold Hills (and to the north and south of it), fast ice continues to break up. The front of the Sørsdal Ice Shelf is free of fast ice, but strips and patches of fast-ice debris are floating southward offshore.

Sabrina Coast

Figure 3 shows a visible scene scene off Sabrina Coast. The fast-ice edge is marked by a red line.

Fast ice of the region continues to break up. East of Law Dome, new (less than 18 hours old) cracks through the fast ice are marked by dashed, orange lines. Off the Moscow University Ice Shelf, the fast-ice edge has been roughly the same during the last week, with only small pieces of fast ice breaking off the edge.

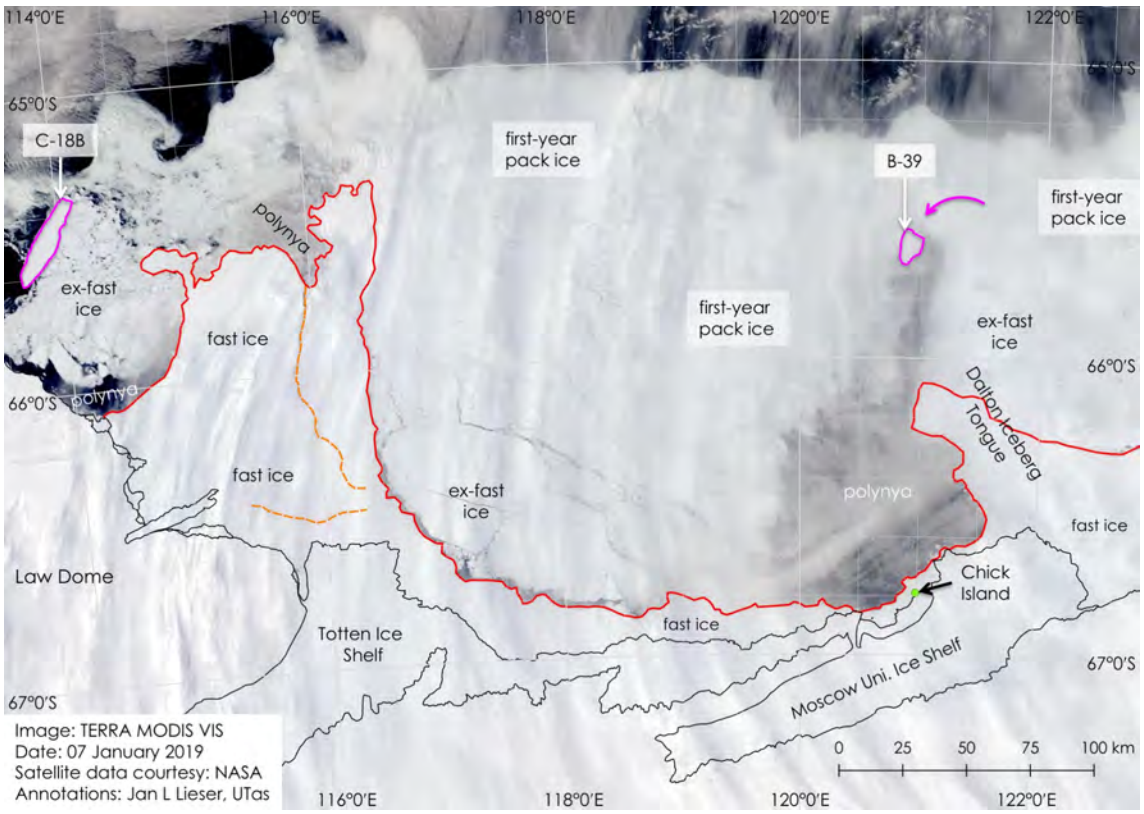

Figure 3: *TERRA MODIS VIS scene acquired on 07/01/2019 and provided by NASA.*

Iceberg B-39 has turned the corner around the northern edge of the icebergs of the Dalton Iceberg Tongue and entered the polynya west of the iceberg tongue.

Sea Ice Report #02.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
08/01/2019

D'Urville Sea

Figure 1 shows a visible scene of the coastal D'Urville Sea. The orange line marks the recent track of OPV *l'Astrolabe* in the region (up until 07/01/2019 22:00 UT, north of Commonwealth Bay). The fast-ice edge is marked by a red line.

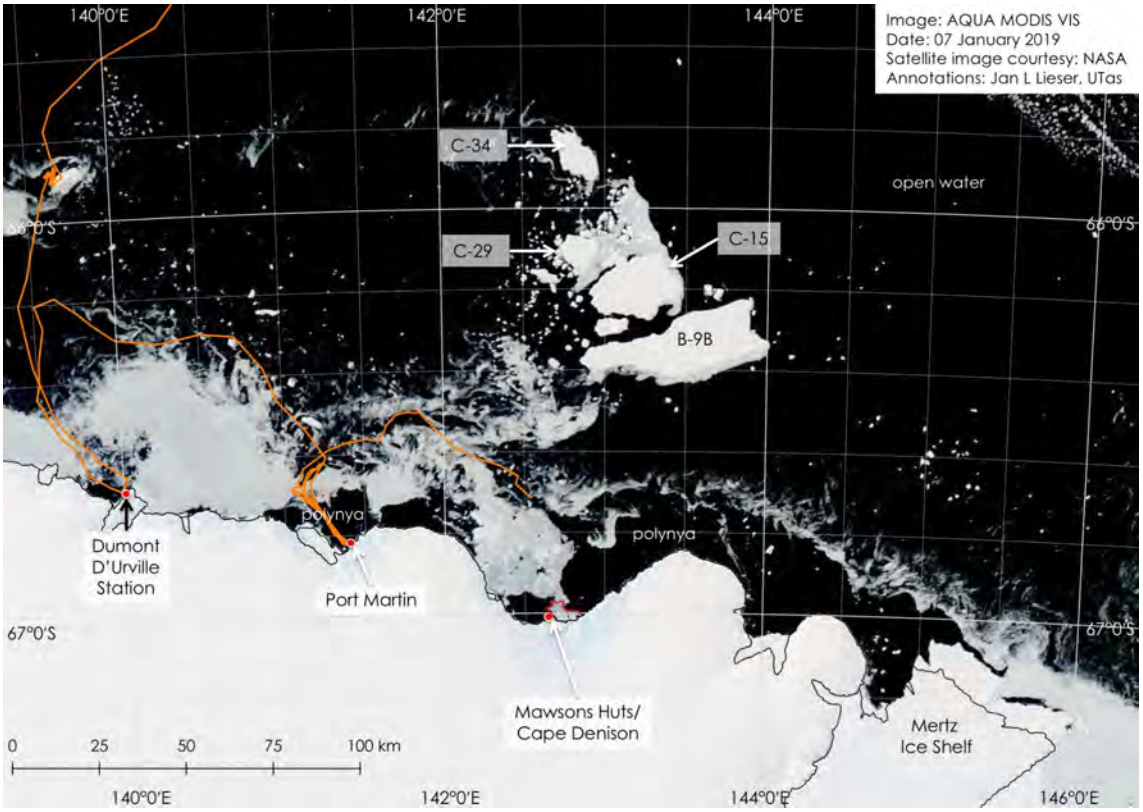

Figure 1: *AQUA MODIS VIS data acquired 07/01/2019 and provided by NASA.*

Between Dumont D'Urville Station and Cape Denison, drifting sea ice consists predominantly of deteriorating ex-fast ice.

Only east of Cape Denison, very little fast ice remains shorefast. Fast ice off the western side of Commonwealth Bay (see Sea Ice Report #02.1/2019) appears to be detaching.

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Sea Ice Report #02.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
08/01/2019

Davis Station

Figure 1 shows a high-resolution SAR scene of Davis Station and vicinity.

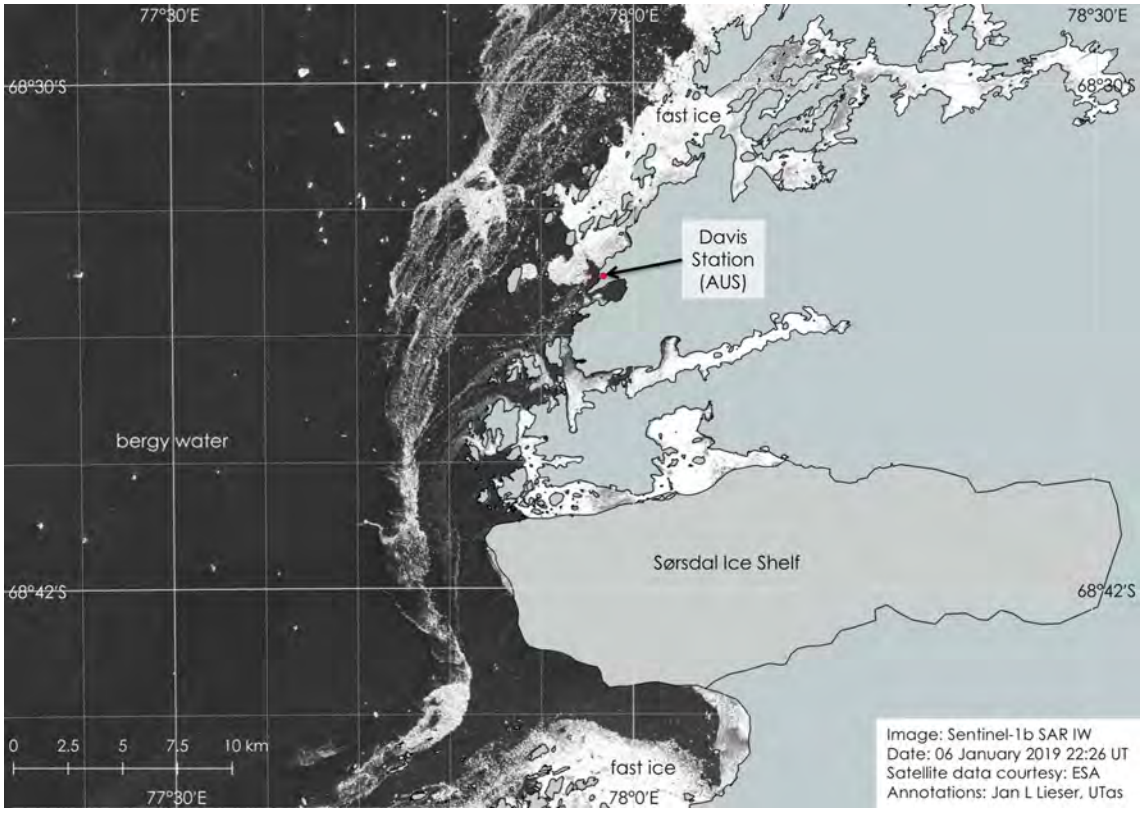

Figure 1: *Sentinel-1b SAR IW scene acquired on 06/01/2019 at 22:26 UT and provided by PolarView.*

Strips and patches of ex-fast ice are streaming southward along the coast with the surface current. As long as there is fast ice breaking up north of the station, such strips and patches can be expected to continue their drift offshore.

The front of the Sørsdal Ice Shelf is free of fast ice, but off the Rauer Group (the group of islands south of the Sørsdal Ice Shelf), fast ice is still present but breaking up.

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Sea Ice Report #02.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
08/01/2019

Ross Sea

Figure 1 shows a sea-ice concentration chart of the western Ross Sea with the sea-ice extent during the past five days marked as coloured lines.

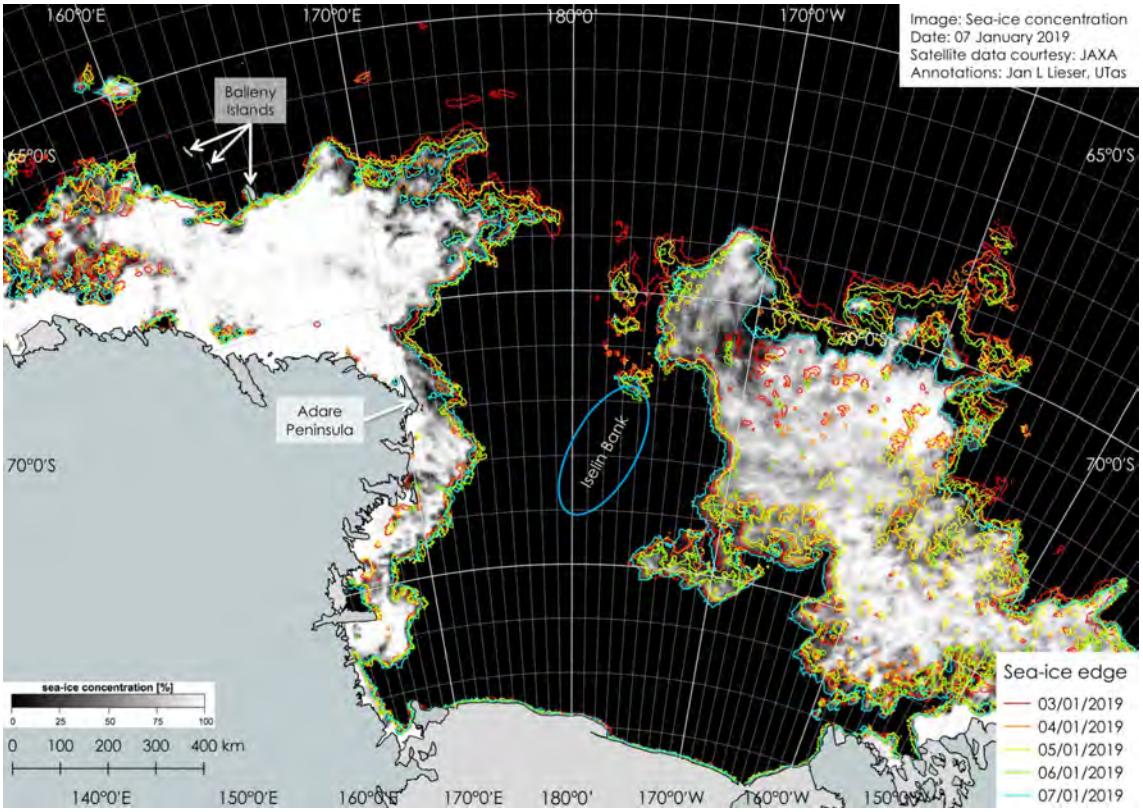

Figure 1: *Sea-ice concentration chart acquired 07/01/2019 and provided by ICDC/Universität Hamburg.*

In the Ross Sea, sea ice shows consistent pattern of retreat, the evolution of which is visualised by the sea-ice extents for the past couple of days.

South of the Balleny Islands and towards Adare Peninsula, a large patch of high-concentration sea ice remains.

Iselin Bank is largely free of any sea ice, only at its northern edge a small patch of decaying sea ice remains.

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Sea Ice Report #02.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
08/01/2019

This report provides a brief update to Sea Ice Report #02.3/2019.

D'Urville Sea

Figure 1 shows a visible scene of the coastal D'Urville Sea. The orange line marks the recent track of OPV *l'Astrolabe* in the region (up until 08/01/2019 02:00 UT, north of Commonwealth Bay).

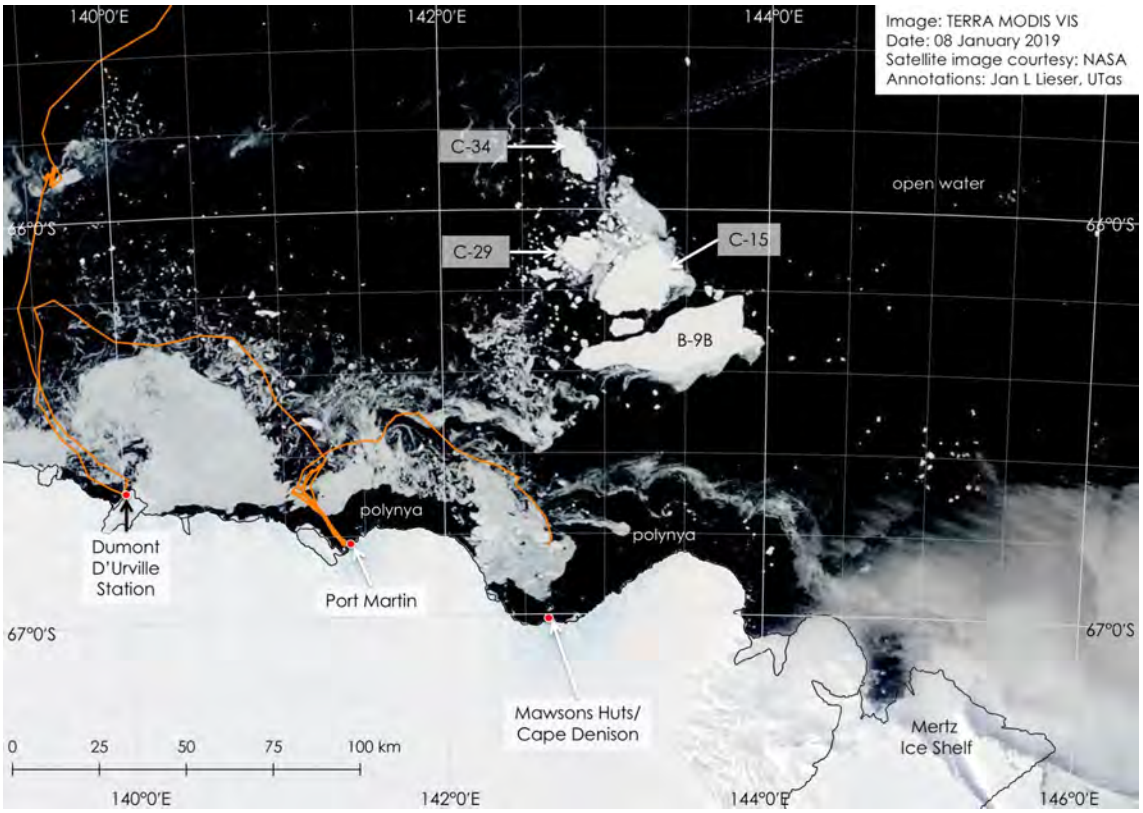

Figure 1: *TERRA MODIS VIS data acquired 08/01/2019 and provided by NASA.*

East of Cape Denison, the last patch of remaining shore-fast sea ice has broken off.

Icebergs B-9B and C-15 are drifting slightly northward, while iceberg C-34 swivels a little around its southern edge and iceberg C-29 is not moving.

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Sea Ice Report #02.7/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
08/01/2019

Sabrina Coast

Figure 1 shows a visible scene scene off Sabrina Coast. The fast-ice edge based on visible data from 07/01/2019 is marked by a red line.

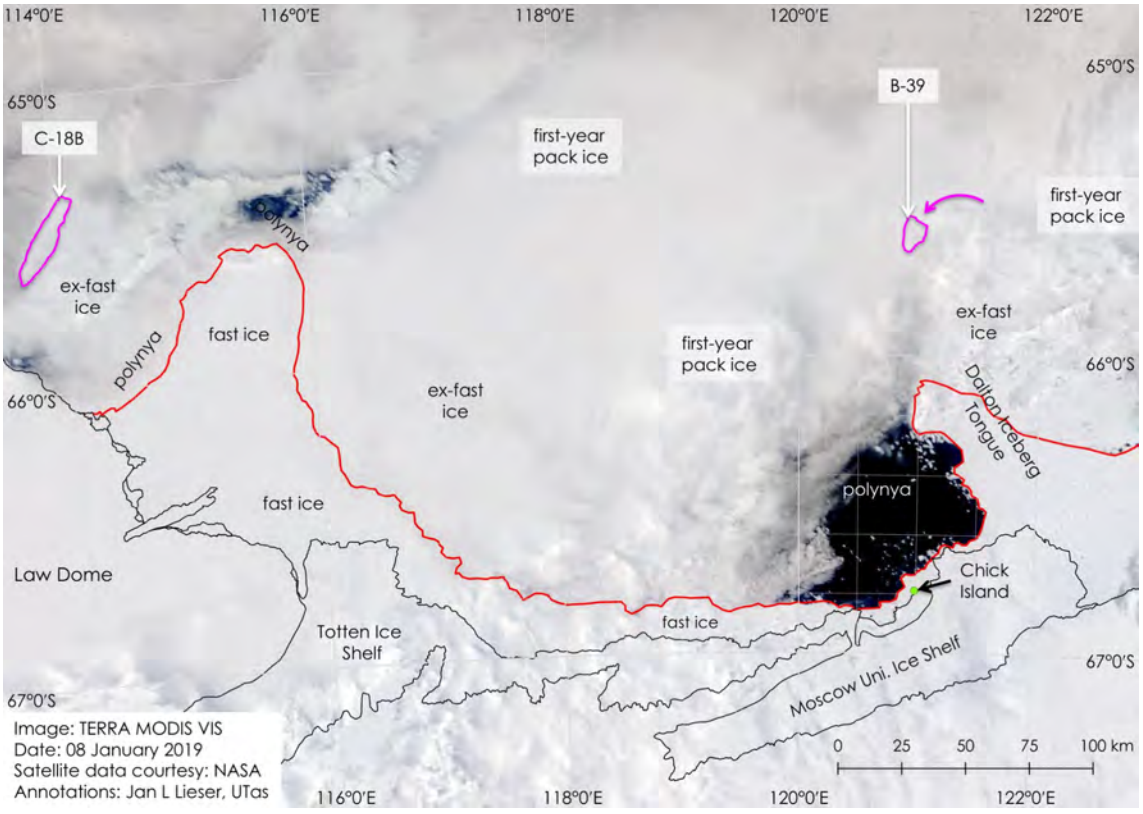

Figure 1: *TERRA MODIS VIS scene acquired on 08/01/2019 and provided by NASA.*

Fast ice in the region continues to break up. East of Law Dome, a previously identified new crack through the fast ice (see Sea Ice Report #02.2/2019) has fully developed and separated a large piece of now ex-fast ice.

Off the Moscow University Ice Shelf, the fast-ice edge has been largely stable during the past two days, while only small pieces of fast ice are breaking off the edge.

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Sea Ice Report #02.8/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
09/01/2019

Sabrina Coast

Figure 1 shows a SAR scene scene off Sabrina Coast. The fast-ice edge is marked by a red line.

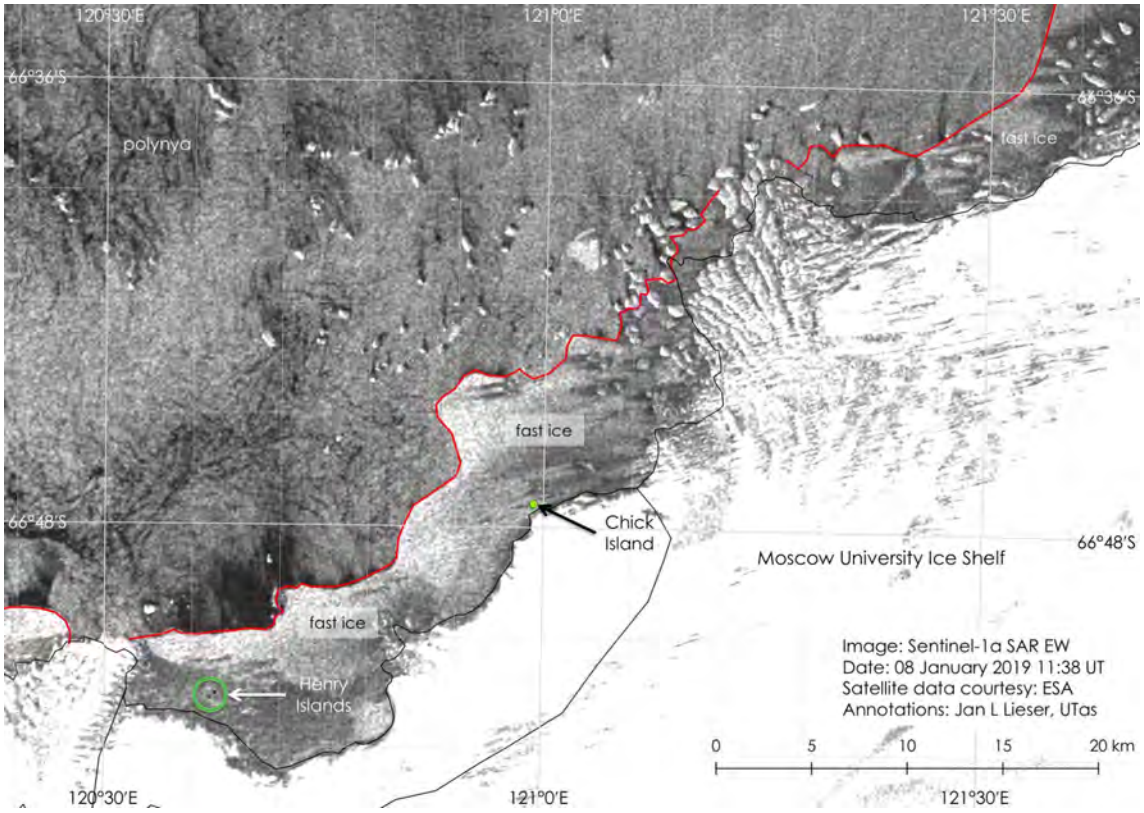

Figure 1: *Sentinel-1a SAR EW scene acquired on 08/01/2019 at 11:38 UT and provided by PolarView.*

Off the Moscow University Ice Shelf, the fast-ice edge has been largely stable during the past two days, while only small pieces of fast ice are breaking off the edge.

Off the fast-ice edge, many icebergs are in the polynya, some of them grounded, some of the freely drifting.

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Sea Ice Report #02.9/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
09/01/2019

Mawson Station

Figure 1 shows a SAR scene scene off Mawson Coast. The fast-ice edge is marked by a red line.

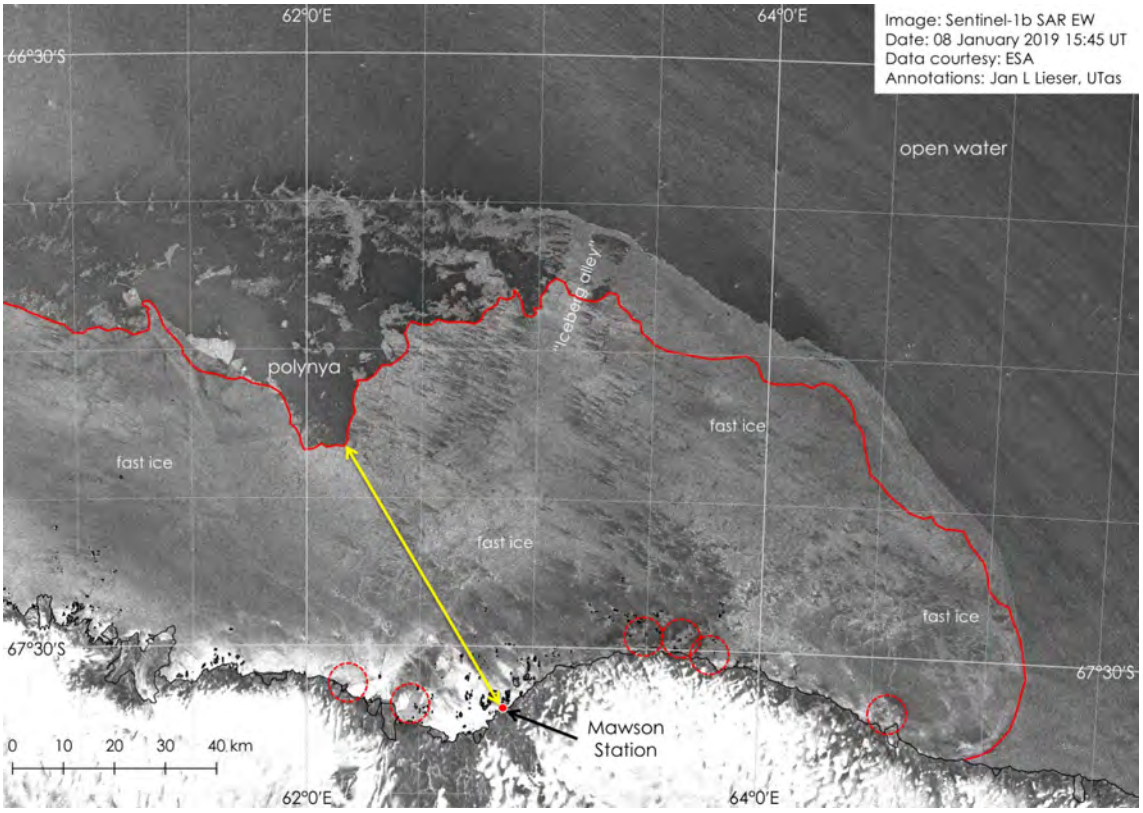

Figure 1: *Sentinel-1b SAR EW scene acquired on 08/01/2019 at 15:45 UT and provided by PolarView.*

The fast-ice edge is retreating steadily towards the coast. The northern half of the so-called 'iceberg alley' is already free of fast ice, although the ex-fast ice has not yet been exported from the alley.

Nearshore, the fast ice is showing continued signs of deterioration, some of those areas are marked by dashed, red circles. The shortest distance to the polynya northwest of the station is 32.5 nautical miles (yellow arrow).

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Davis Station

Figure 2 shows a SAR scene scene of the Vestfold Hills and offshore. The fast-ice edge is marked by a red line.

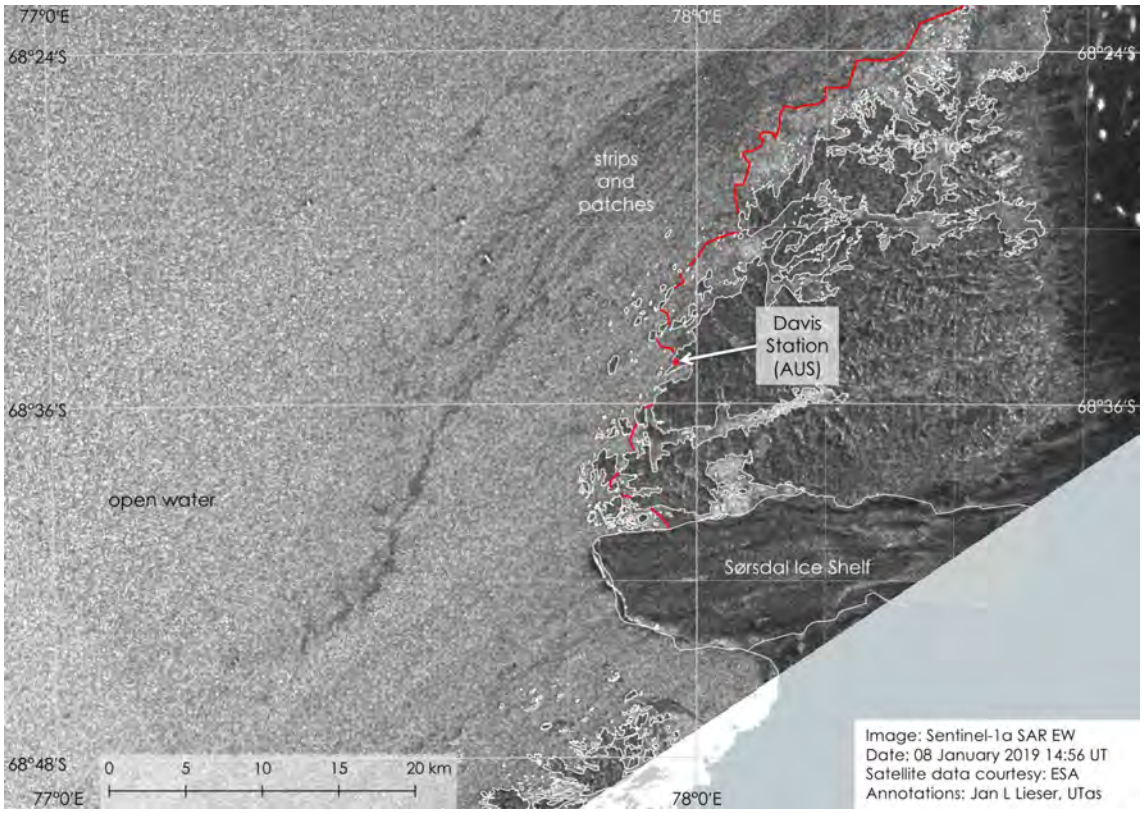

Figure 2: *Sentinel-1a SAR EW scene acquired on 08/01/2019 at 14:56 UT and provided by PolarView.*

Off the Vestfold Hills, fast-ice is breaking off. Strips and patches of ex-fast ice continue their drift southward offshore.

South of the Sørsdal Ice Shelf, fast ice surrounding the islands of the Rauer Group is also breaking up.

Sabrina Coast

Figure 3 shows a visible scene scene off Sabrina Coast. The fast-ice edge is marked by a red line.

The extent of fast-ice breakup in the region becomes apparent in the cloud-free scene (clouds are only present over the open water north of the ice edge). North of Casey Station, the fast ice is shrinking as well as north of the Totten Ice Shelf. Fast ice between the icebergs of the Dalton Iceberg Tongue also continues to break up.

Iceberg B-39 can be seen drifting southward in the polynya west of the iceberg tongue.

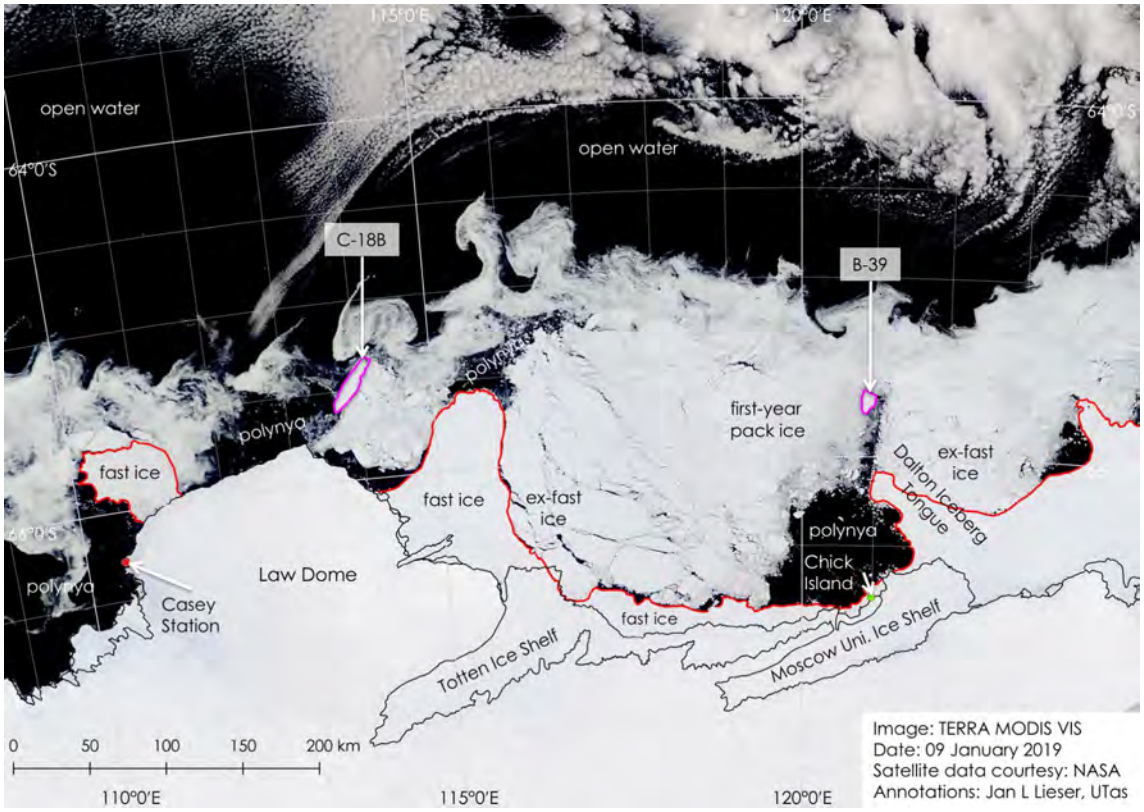

Figure 3: *TERRA MODIS VIS scene acquired on 09/01/2019 and provided by NASA.*

Sea Ice Report #02.10/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
09/01/2019

D'Urville Sea and Ross Sea

Figure 1 shows a sea-ice concentration chart of the eastern D'Urville Sea and western Ross Sea. Additionally, the sea-ice edge on 04/01/2019, 05/01/2019, 06/01/2019 and 07/01/2019 is marked as a red, orange, yellow and green line, respectively.

The cyan line indicates the median sea-ice extent for January in the region.

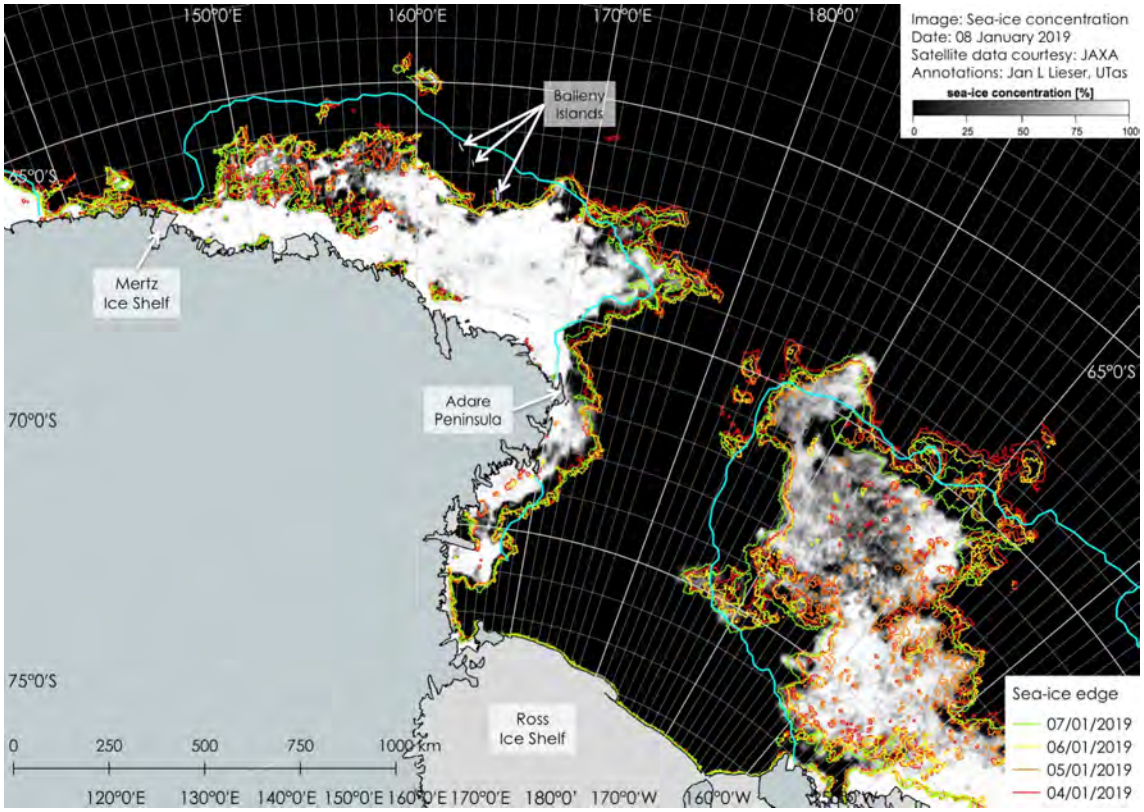

Figure 1: *Sea-ice concentration data acquired 08/01/2019 and provided by ICDC/Universität Hamburg.*

Generally, the sea-ice extent is already within the long-term median for January. South of the Balleny Islands and towards Adare Peninsula, a large patch of high-concentration sea ice still remains. But in eastern D'Urville Sea and the Ross Sea, sea ice shows advanced patterns of retreat.

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Sea Ice Report #02.11/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
11/01/2019

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for December 2018.

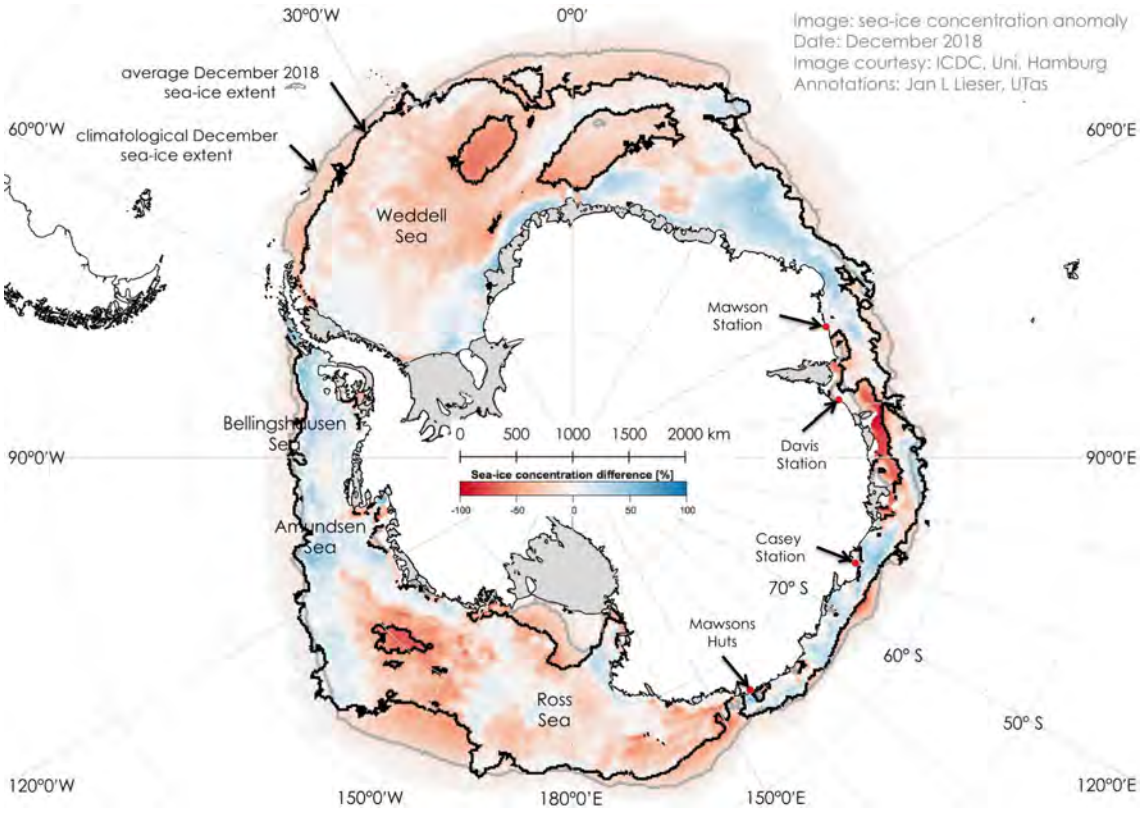

Figure 1: *Sea-ice concentration anomaly for December 2018 provided by ICDC, Universität Hamburg.*

In December 2018, sea-ice extent remained much below average (relative to 1992-2017) conditions throughout most of Antarctica, as can be seen by the continuous red sea-ice margin in the chart (Figure 1).

The Weddell Sea and Ross Sea show large sea-ice concentration deficits, while the Bellingshausen Sea and Amundsen Sea exhibit slightly above average concentration within close-to average extent. In East Antarctica, contrasting patterns of anomalous sea-ice concentration along the coast are found within generally below average extent.

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Cooperation Sea

Figure 2 shows a sea-ice concentration chart of Cooperation Sea. Additionally, the sea-ice extent during the previous week is marked by coloured lines and the median sea-ice extent for January (solid, black line) and February (dashed, black line) are also given.

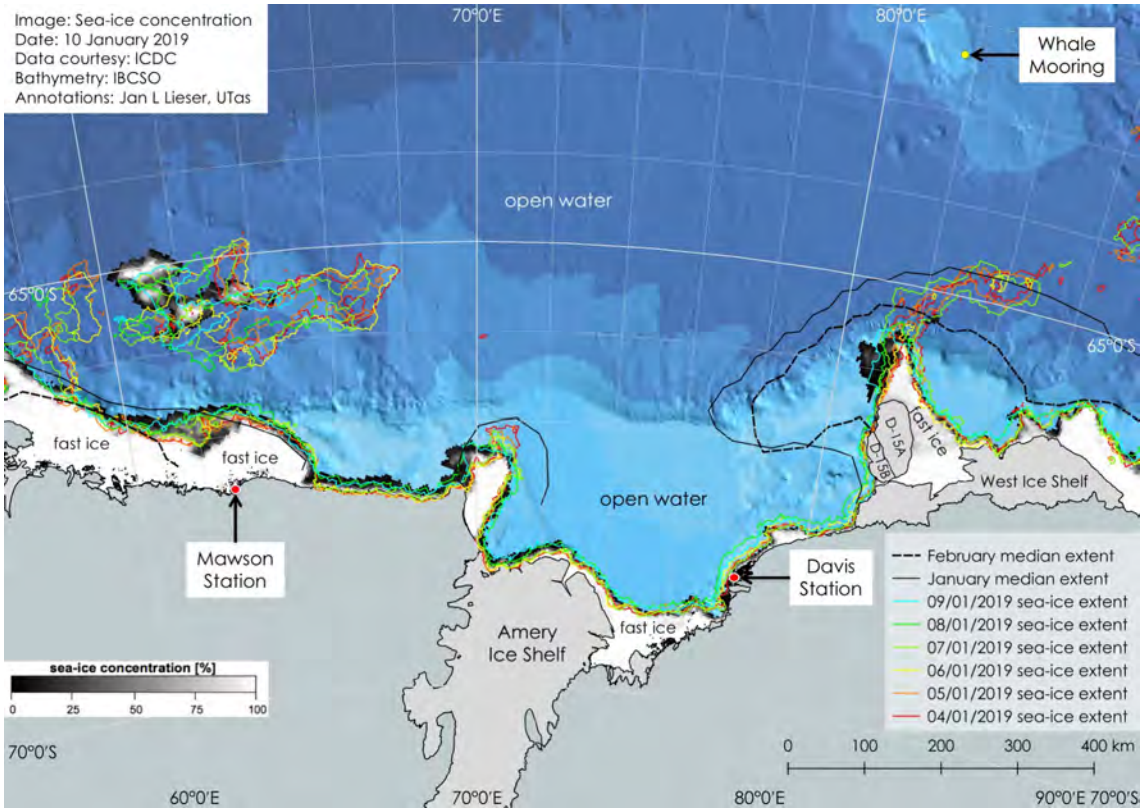

Figure 2: *Sea-ice concentration data acquired 10/01/2019 and provided by ICDC, Universität Hamburg.*

The advanced retreat of sea ice in the region is illustrated by the consecutive sea-ice extent lines. Particularly off the West Ice Shelf, the extent has almost reached its annual summer minimum already. But also west of the Amery Ice Shelf, the sea-ice extent is within in the median by this time, except for a remaining patch of quickly shrinking sea ice northwest of Mawson Station, off the fast-ice edge.

Prydz Bay (east of the Amery Ice Shelf and southwest of Davis Station) still holds some fast ice, but north of Davis Station, fast ice is breaking up.

The Whale Mooring is clear of any sea ice, but within the iceberg limit of the Southern Ocean waters.

Davis Station

Figure 3 shows a visible scene of the northwestern Prydz Bay.

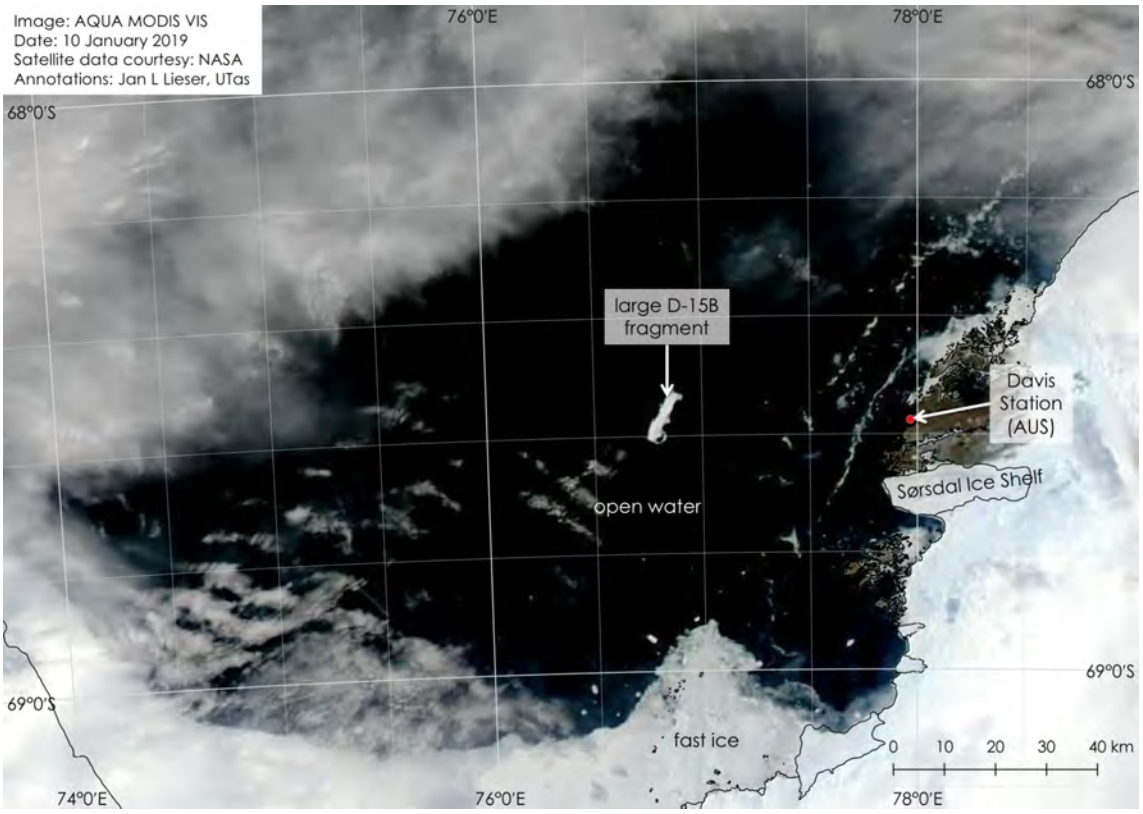

Figure 3: *AQUA MODIS VIS scene acquired 10/01/2019 and provided by NASA.*

Off the Vestfold Hills, small strips and patches of broken ex-fast ice are still drifting southwestward. Around the Rauer Group (south of the Sørsdal Ice Shelf), fast ice continues to break up.

The large fragment of iceberg D-15B is drifting on open water.

D'Urville Sea

Figure 4 shows a high-resolution SAR scene of the Ninnis Ice Shelf.

After the identification of iceberg C-35 in early August 2018, the shelf has now moved sufficiently further northeastward to shed a new iceberg off its front. This new iceberg has an area of approximately 975 km^2, which compares to Brabant Island at the western Antarctic Peninsula (or a little more than half the area of Greater Hobart).

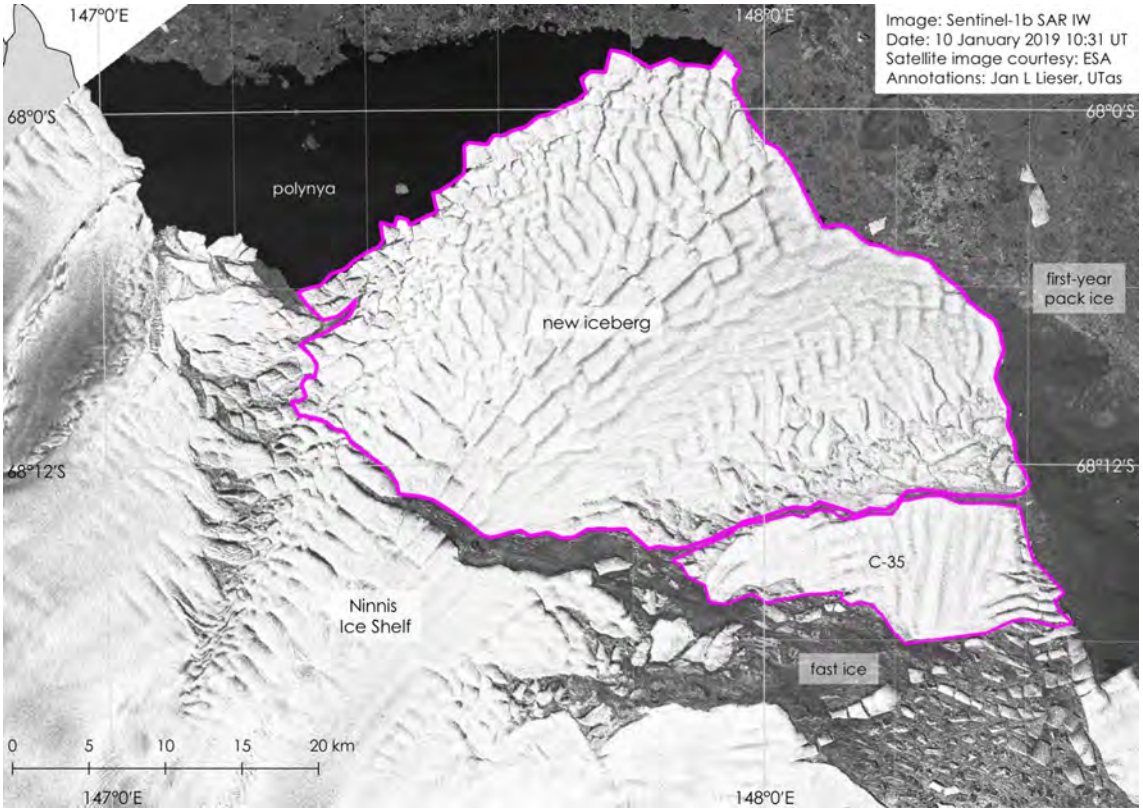

Figure 4: *Sentinel-1b SAR IW scene acquired 10/01/2019 at 10:31 UT and provided by PolarView.*

Sea Ice Report #02.12/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
11/01/2019

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea. Additionally, the sea-ice extent during the previous week is marked by coloured lines and the median sea-ice extent for January (solid, black line) and February (dashed, black line) are also given.

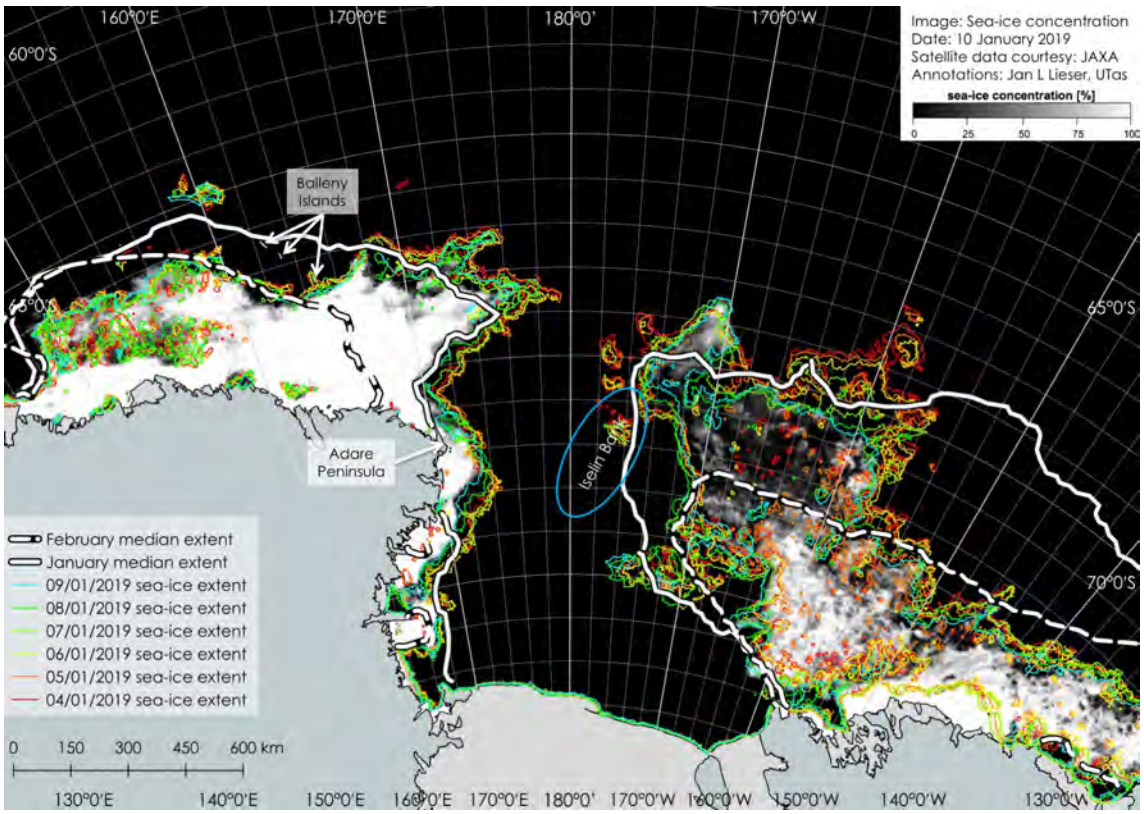

Figure 1: *Sea-ice concentration data acquired 10/01/2019 and provided by ICDC, Universität Hamburg.*

The advanced retreat of sea ice in the region is illustrated by the consecutive sea-ice extent lines. Particularly in the eastern Ross Sea, the extent is below the January median and almost below the February median as well. Between the Balleny Islands and Adare Peninsula, sea ice is shrinking from the north, but the eastern edge of this patch is almost at the January median.

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Sea Ice Report #03.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/01/2019

Mawson Station

Figure 1 shows a visible scene of Mawson Coast. Additionally, the fast-ice edge on 08/01/2019 is marked by a dashed, red line (see Sea Ice Report #02.9/2019).

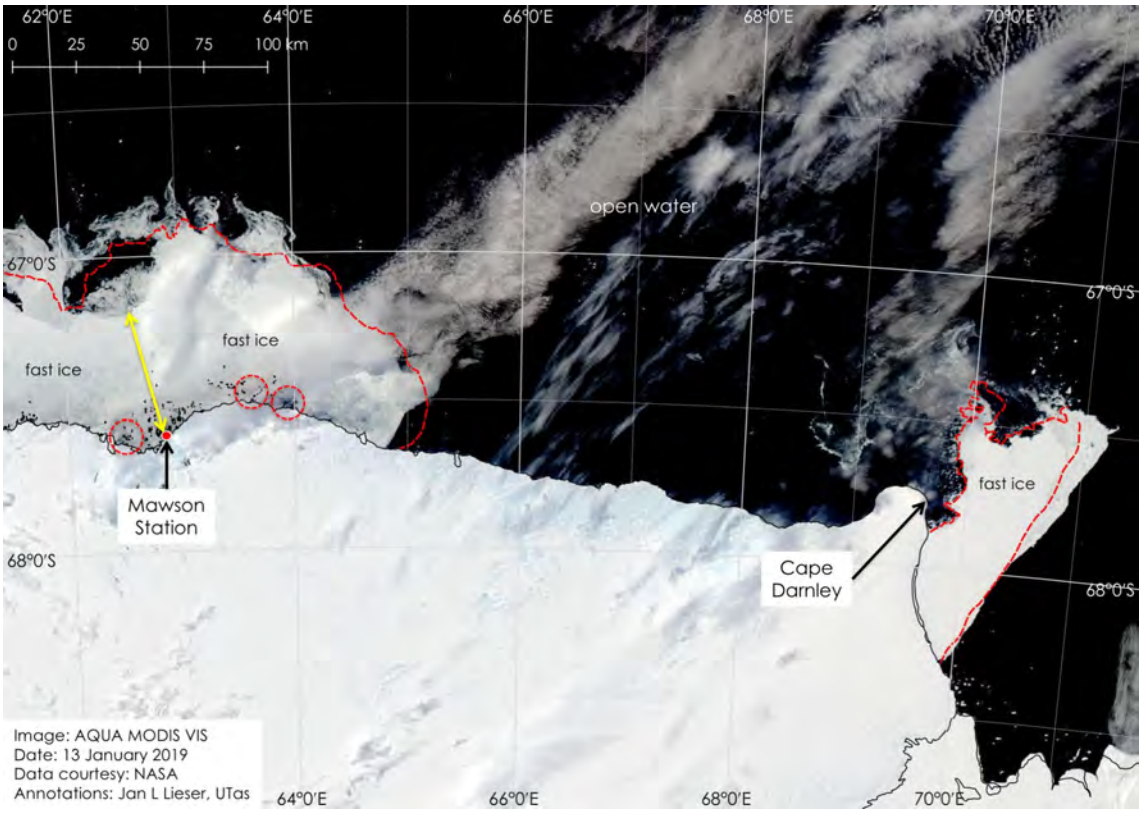

Figure 1: *AQUA MODIS VIS data acquired 13/01/2019 and provided by NASA.*

Off Mawson Station and east of Cape Darnley, fast-ice deterioration is ongoing. The shortest distance to open water northwest of the station is 26 nautical miles (yellow arrow).

Close to shore, fast ice is also melting and breaking up (marked by dashed, red circles). The true extent of this coastal open water is partially obscured by clouds in Figure 1.

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Davis Station

Figure 2 shows a composite of SAR scenes off the Vestfold Hills. The locations of large iceberg fragments during the past four days are marked by coloured shapes.

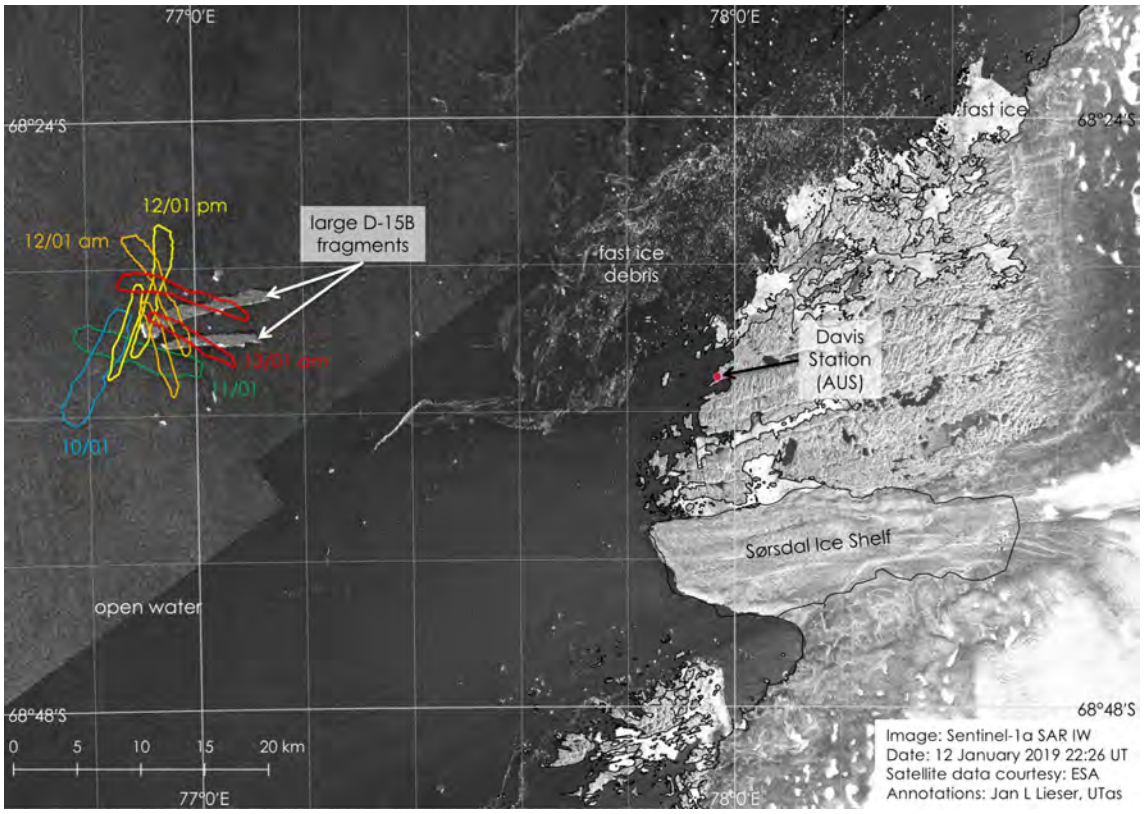

Figure 2: *Sentinel-1a SAR IW scene acquired 12/01/2019 at 22:26 UT complemented in the northwest by Sentinel-1a SAR EW acquired 13/01/2019 at 15:04 UT, both provided by PolarView.*

Off the Vestfold Hills, small strips and patches of broken ex-fast ice are still drifting southwestward. Around the islands of Rauer Group (south of the Sørsdal Ice Shelf), fast ice continues to break up.

The large fragment of iceberg D-15B has continued to rotate offshore and split along its long axis on 11/01/2019 in the afternoon. The two main pieces continue to rotate and are drifting slowly apart. Smaller icebergs are in the proximity of these two bergs, which indicates further instability of the bergs and ongoing break-up.

Sabrina Coast

Figure 3 shows a SAR scene of the northern Moscow University Ice Shelf. The fast-ice edge on 08/01/2019 is marked as a dashed, red line (see Sea Ice Report #02.8/2019).

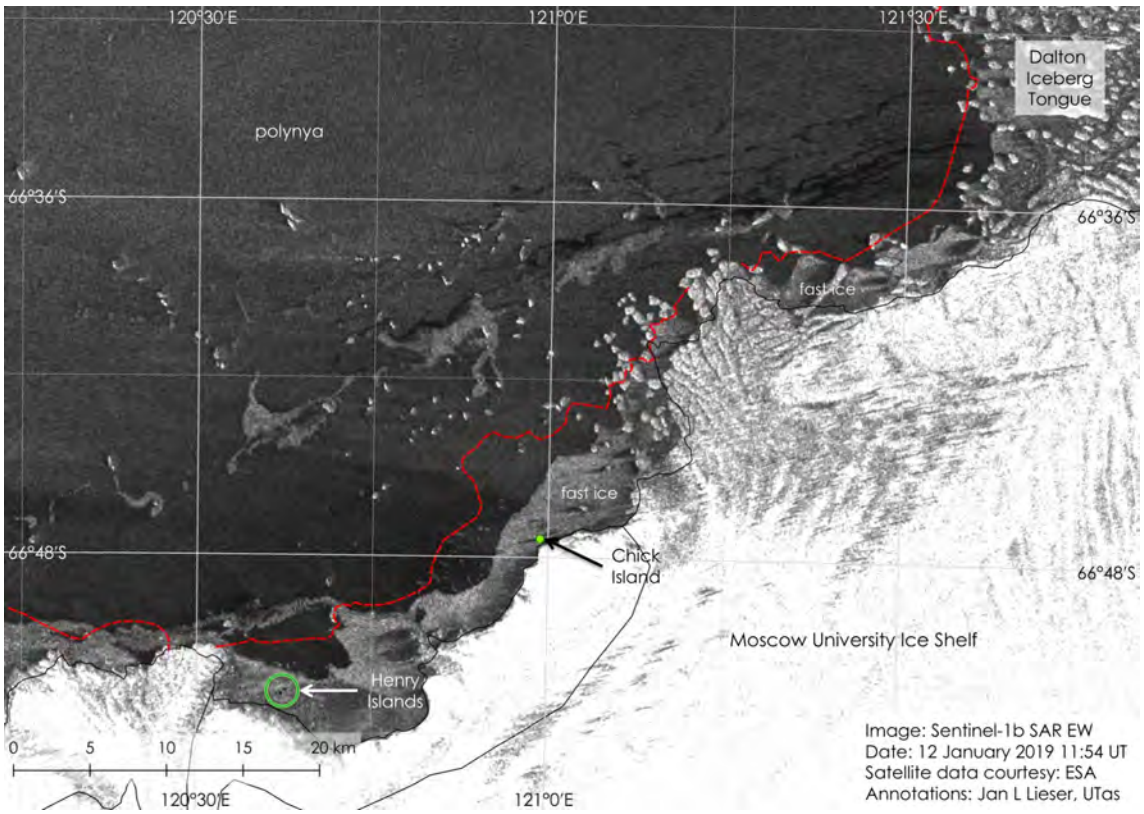

Figure 3: *Sentinel-1b SAR EW scene acquired 12/01/2019 at 11:43 UT and provided by PolarView.*

Off Henry Islands and Chick Island, fast ice is retreating towards the coast and fast-ice debris is drifting off the fast-ice edge.

During the 24 hours following the acquisition of the data shown in Figure 3, iceberg B-39 (not shown in the figure) has travelled approximately 9.5 km southward along the edge of the Dalton Iceberg Tongue and rotated 90 degrees anti-clockwise.

Sea Ice Report #03.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/01/2019

Ross Sea

Figure 1 shows a composite of sea-ice concentration data and a Synthetic Aperture RADAR (SAR) swath of the Ross Sea. Additionally, the sea-ice edge based on passive microwave data (10% sea-ice concentration) is given as a cyan line. The cruise track of RV *Tangaroa* (up until 14/01/2019 03:00 UT; call-sign ZMFR) is marked as a dark blue line.

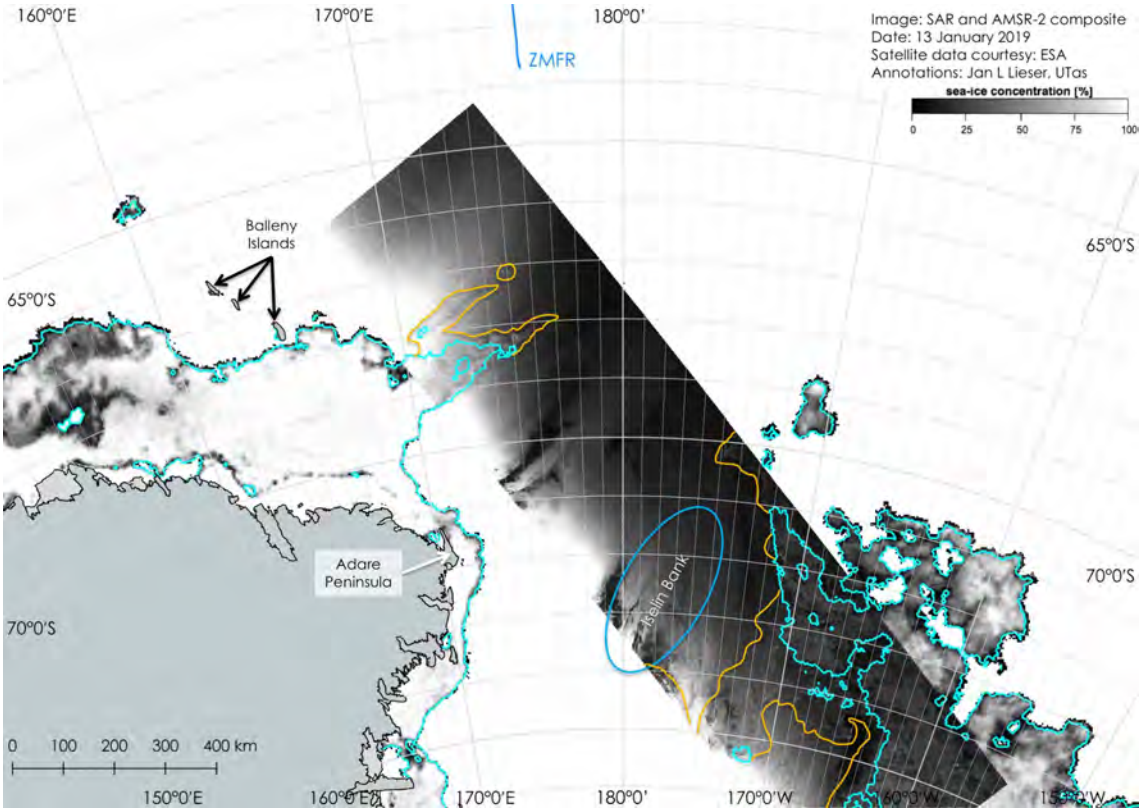

Figure 1: *Sea-ice concentration data acquired 13/01/2019 and provided by ICDC, Universität Hamburg; overlay of Sentinel-1a SAR EW swatch acquired 13/01/2019 at 08:27 UT and provided by PolarView.*

Orange lines mark areas of strips and patches of very low areal sea-ice concentration that is below the detection limit of the passive microwave system AMSR-2, from which sea-ice concentration is derived.

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Sea Ice Report #03.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
15/01/2019

Ross Sea

Figure 1 shows a Synthetic Aperture RADAR (SAR) scene of the central Ross Sea. Punch holes in the SAR data along 180° are the result of a data-processing artefact. Additionally, the seabed topography is given by colour-coded lines. Regions of deteriorating, very-low concentration sea ice are outlined by dashed, orange lines.

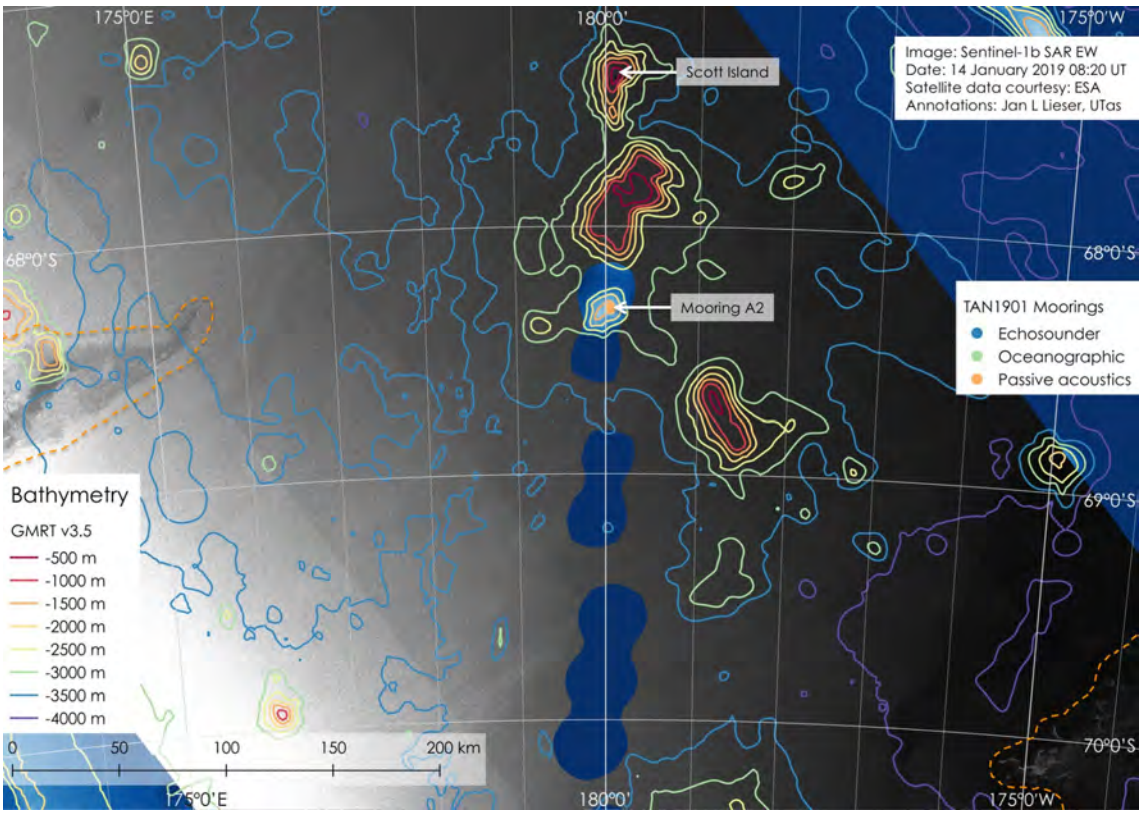

Figure 1: *Sentinel-1b SAR EW data acquired 14/01/2019 at 08:20 UT and provided by PolarView.*

The location of Mooring A2 is within a punch hole, but the surrounding region suggests there should be no sea ice present at this position. However, icebergs and smaller pieces of ice of land origin can be expected throughout the entire scene of Figure 1.

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Figure 2 shows a high-resolution Synthetic Aperture RADAR (SAR) scene off Adare Peninsula. The seabed topography is given by colour-coded lines.

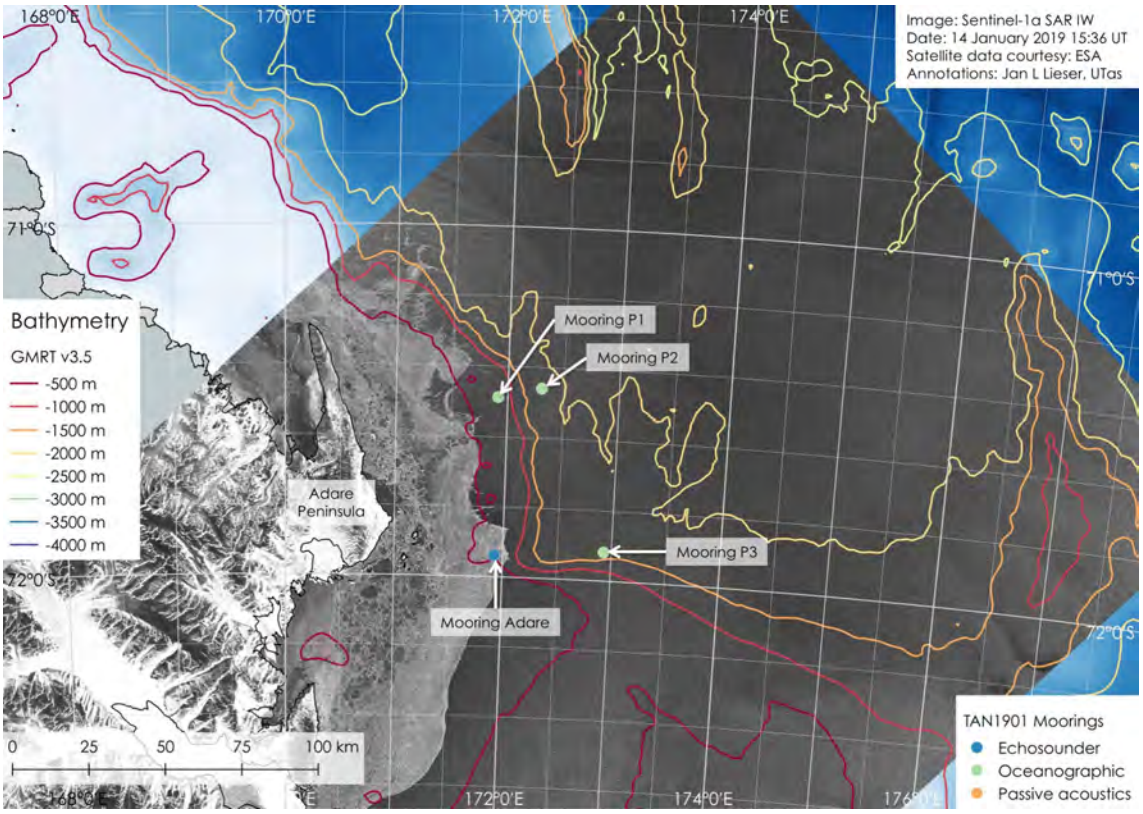

Figure 2: *Sentinel-1a SAR IW data acquired 14/01/2019 at 15:36 UT and provided by PolarView.*

The presence of sea ice in the region is largely restricted to areas of less than roughly 20 nautical miles offshore, but icebergs and smaller pieces of ice of land origin can be expected throughout the entire scene of Figure 2.

Moorings P1, P2 and P3 are currently free of sea ice. Mooring Adare is still covered by sea ice at the edge of the sea-ice zone.

Sea Ice Report #03.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
16/01/2019

Ross Sea

Figure 1 shows a composite of a SAR swath and sea-ice concentration data of the western Ross Sea. Additionally, the sea-ice edge based on sea-ice concentration data is shown as cyan line. The dotted, white frame marks the extent of the SAR swath. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light blue (up until 16/01/2019 02:30 UT).

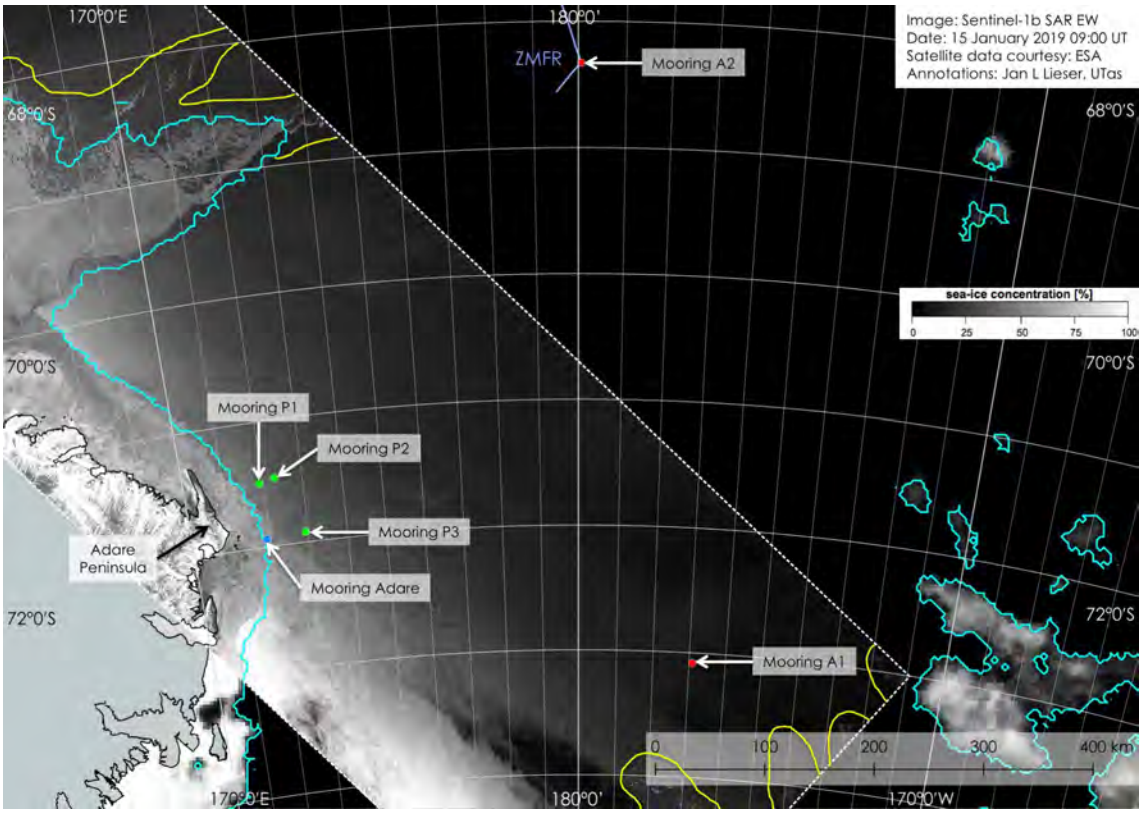

Figure 1: *Sentinel-1b SAR EW swath acquired 15/01/2019 at 09:00 UT and provided by PolarView; complemented by sea-ice concentration data acquired 15/01/2019 and provided by ICDC, Universtät Hamburg.*

Yellow scribble lines show areas of strips and patches of sea ice that are below the detection limit of the sea-ice concentration data algorithm. Mooring 'Adare' is at the edge of the sea-ice zone, where the sea ice was retreating westward (towards the coast) during the past 24 hours.

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Sea Ice Report #03.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
17/01/2019

Mawson Station

Figure 1 shows a visible scene of Mawson Coast. The fast-ice edge is marked by a red line.

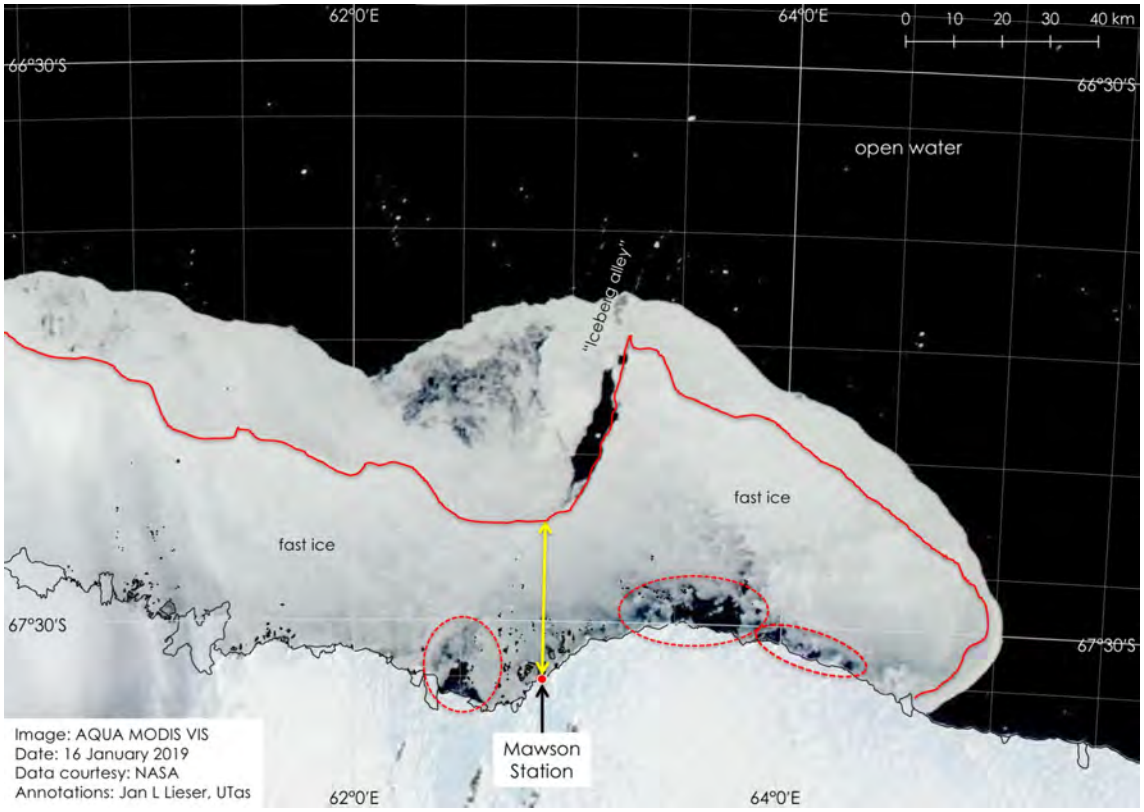

Figure 1: *AQUA MODIS VIS data acquired 16/01/2019 and provided by NASA.*

Off Mawson Station, fast-ice deterioration is progressing. The shortest distance to the fast-ice edge north of the station is 17.5 nautical miles (yellow arrow).

Close to shore, fast ice is also melting and breaking up (marked by dashed, red circles).

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Davis Station

Figure 2 shows a visible scene off the Vestfold Hills. The locations of two large iceberg fragments during the past three days are marked by coloured shapes.

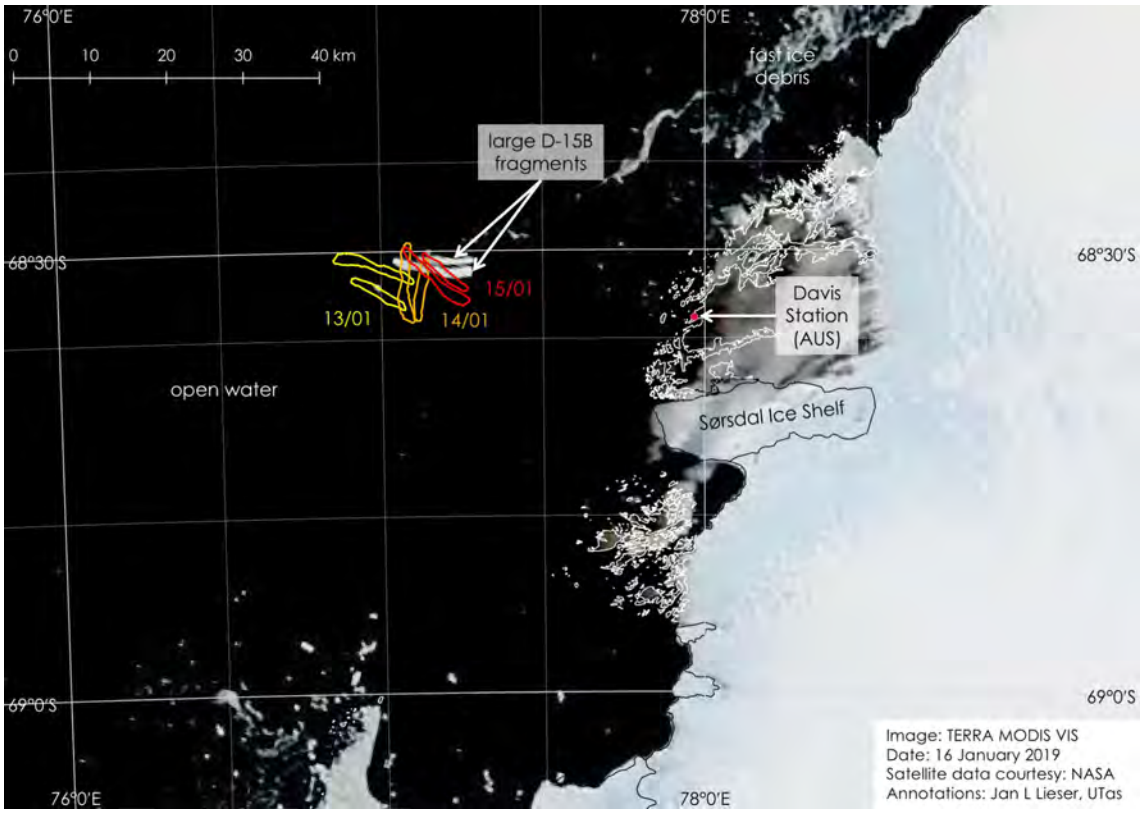

Figure 2: *TERRA MODIS VIS data acquired 16/01/2019 and provided by NASA.*

Off the Vestfold Hills, small strips and patches of broken ex-fast ice are still drifting southwestward. Around the islands of Rauer Group (south of the Sørsdal Ice Shelf), fast ice continues to break up.

The large fragments of iceberg D-15B continue to rotate anti-clockwise offshore. Smaller icebergs in the proximity of these two bergs indicate further instability of the bergs and ongoing break-up.

Sea Ice Report #03.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
18/01/2019

Ross Sea

Figure 1 shows a composite of SAR and visible data of the northwestern Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light blue (up until 18/01/2019 00:30 UT).

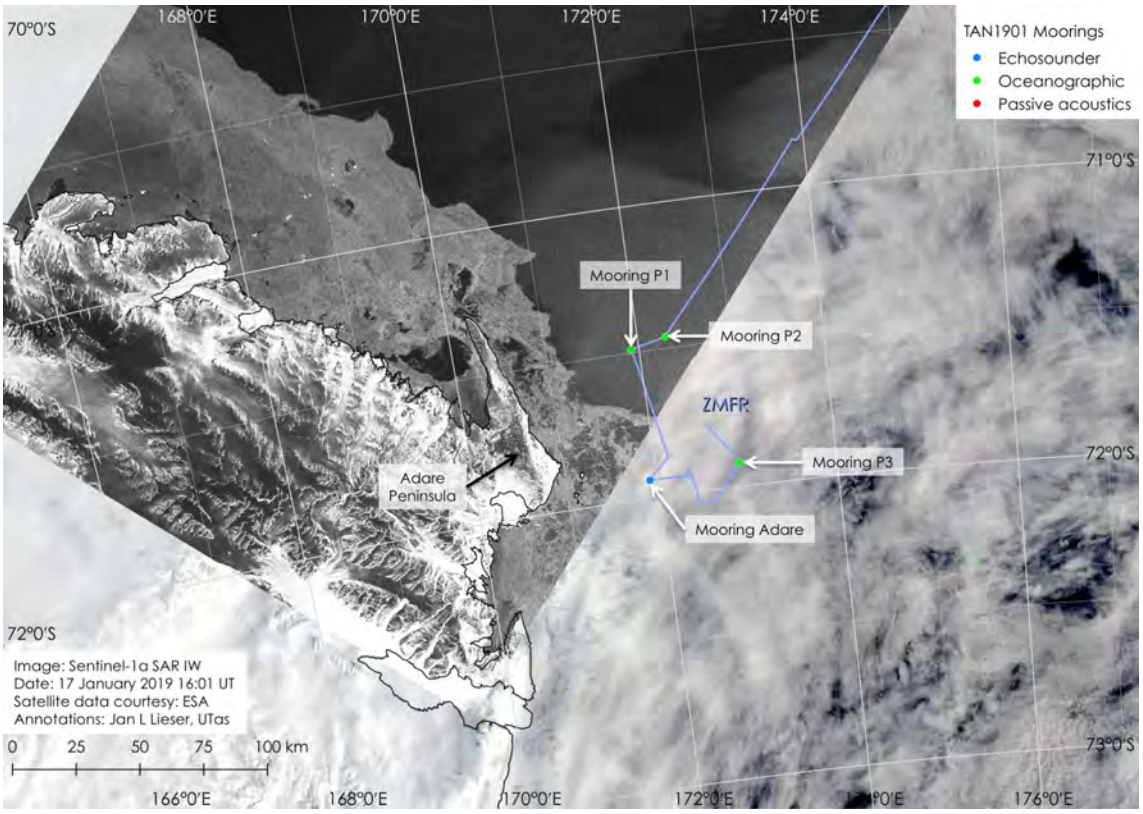

Figure 1: *Sentinel-1a SAR IW scene acquired 17/01/2019 at 16:01 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired 17/01/2019 and provided by NASA.*

Moorings P1, P2 and P3 are off the sea-ice edge, but a relaxing sea-ice zone has covered the location of Mooring 'Adare' temporarily with sea ice again.

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Sea Ice Report #03.7/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
18/01/2019

Mawson Station

Figure 1 shows a high-resolution SAR and visible composite of Mawson Coast. The fast-ice edge is marked by a red line and the fast-ice edge 24 hours ago by dotted, red lines.

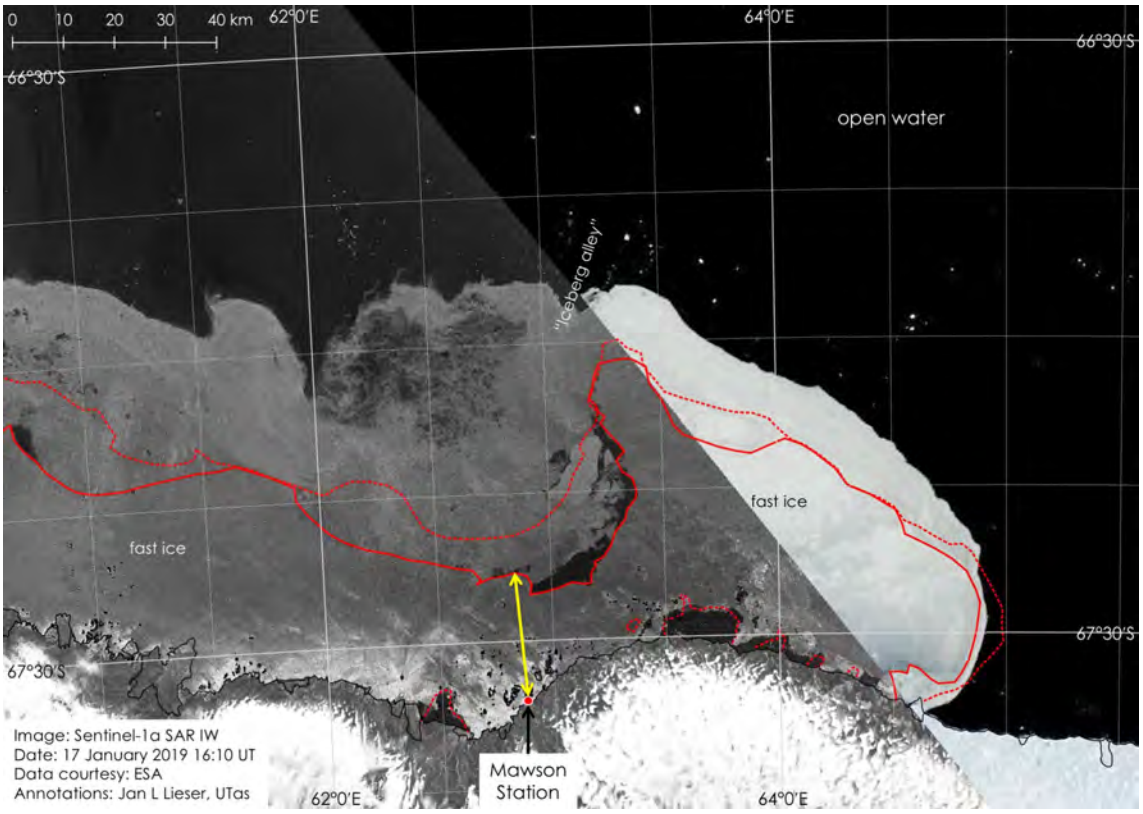

Figure 1: *Sentinel-1b SAR IW scene acquired 17/01/2019 at 16:10 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired 17/01/2019 and provided by NASA.*

Off Mawson Station, fast-ice deterioration is progressing. During the past 24 hours, the shortest distance to the fast-ice edge north of the station was reduced by roughly 4 nautical miles and is now 13.5 nautical miles (yellow arrow).

Close to shore, fast ice continues melting and breaking up.

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Sea Ice Report #03.8/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
18/01/2019

D'Urville Sea and Ross Sea

Figure 1 shows a sea-ice concentration chart of the eastern D'Urville Sea and western Ross Sea. The evolution of the sea-ice edge during the past four days is marked by coloured lines. The cyan line indicates the median sea-ice extent for January in the region.

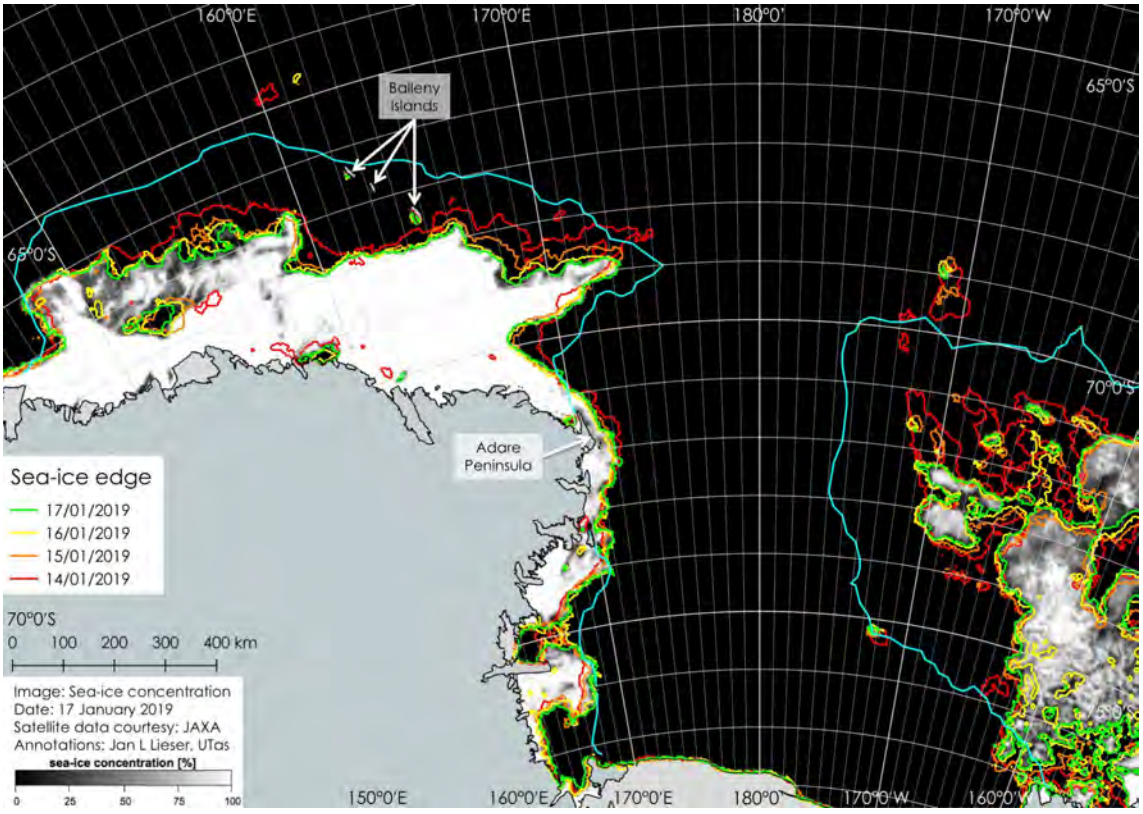

Figure 1: *Sea-ice concentration data acquired 17/01/2019 and provided by ICDC/Universität Hamburg.*

Generally, the sea-ice extent is already within the long-term median for January, except for a region around Adare Peninsula.

In eastern D'Urville Sea and the central Ross Sea, sea ice shows advanced patterns of retreat.

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Sea Ice Report #04.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
21/01/2019

Ross Sea

Figure 1 shows a composite of SAR and visible data of the northwestern Ross Sea. Punch holes along 180° longitude in the western SAR swath are a data processing artefact. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light blue (up until 20/01/2019 22:20 UT). Areas of sea-ice presence are outlined by a yellow line.

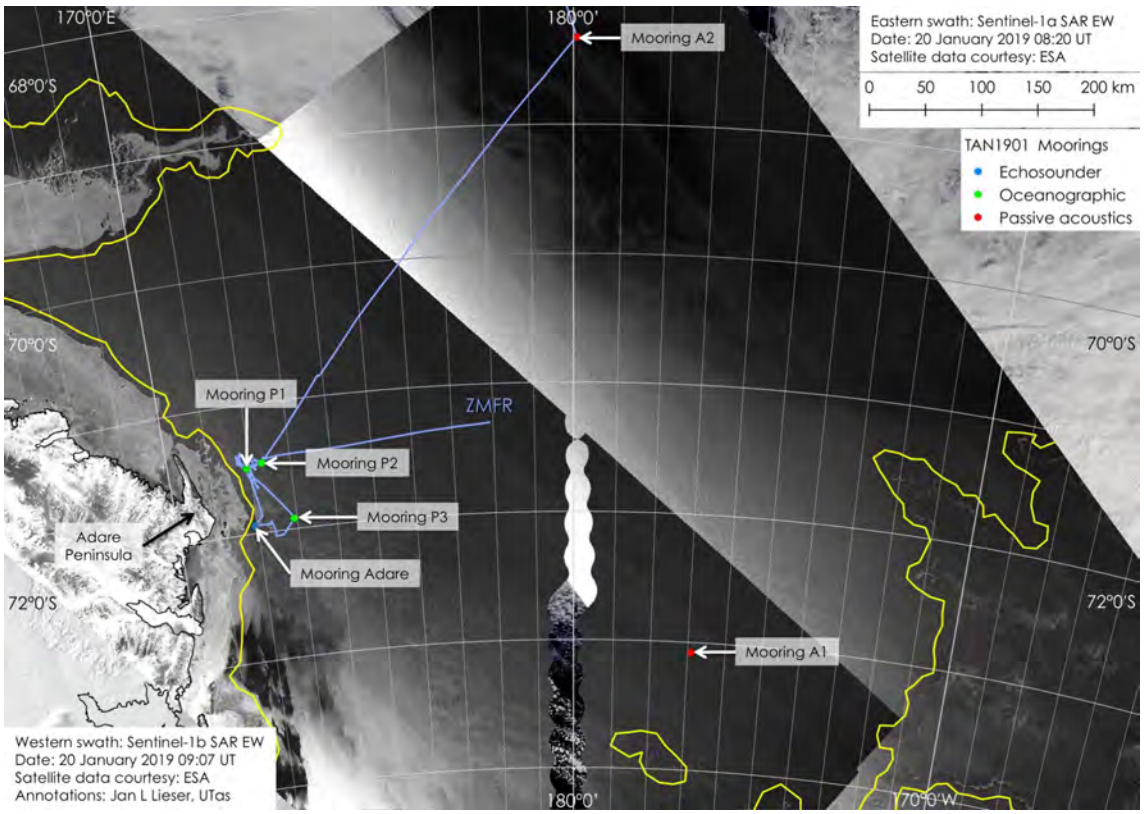

Figure 1: *Sentinel-1b SAR EW data (western swath) acquired 20/01/2019 at 09:07 UT and Sentinel-1a SAR EW data (eastern swath) acquired 20/01/2019 at 08:20 UT, both provided by PolarView; complemented by AQUA MODIS VIS data acquired 20/01/2019 and provided by NASA.*

All marked mooring locations are free of sea ice, however in the entire region shown in Figure 1, icebergs and iceberg fragments can be present.

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Sea Ice Report #04.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
21/01/2019

Mawson Station

Figure 1 shows a visible scene of Mawson Coast. The fast-ice edge on 17/01/2019 is marked by a dashed, red line.

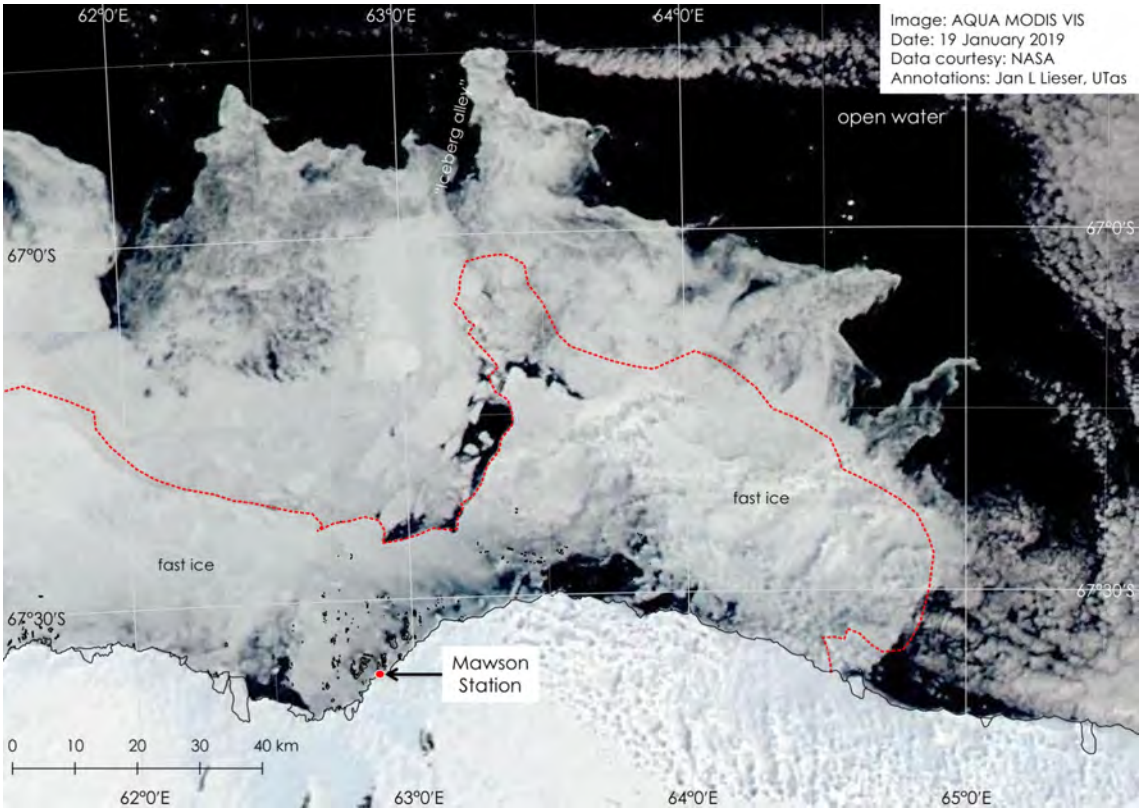

Figure 1: *AQUA MODIS VIS data acquired 19/01/2019 and provided by NASA.*

Off Mawson Station, the shortest distance to the fast-ice edge north of the station has not changed significantly during the past four days, but the further deterioration of near-shore fast ice is notable.

East of 63° 15' E, the fast-ice edge has moved southward and large areas of predominantly ex-fast ice are north of the fast-ice edge.

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Davis Station

Figure 2 shows a high-resolution SAR scene off the Vestfold Hills. The locations of two large iceberg fragments since 16/01/2019 are marked by coloured shapes.

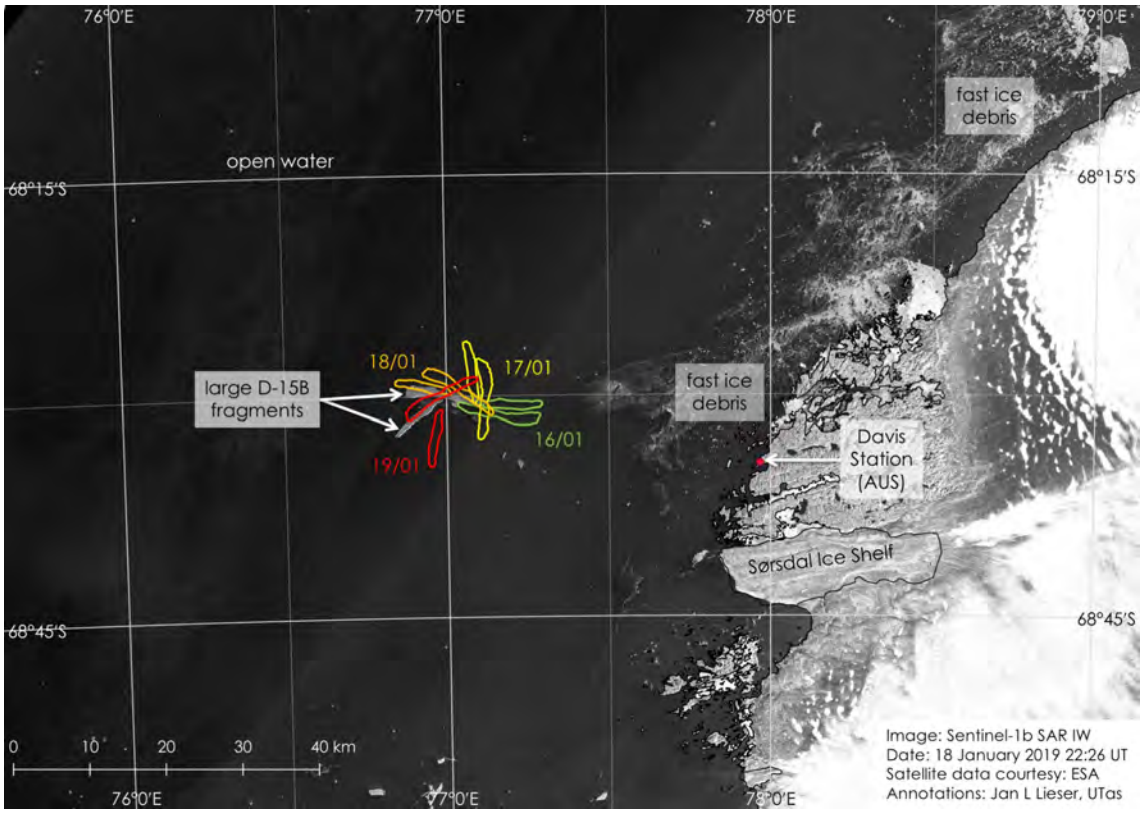

Figure 2: *Sentinel-1b SAR IW data acquired 18/01/2019 at 22:26 UT and provided by PolarView.*

Off the Vestfold Hills, small strips and patches of broken ex-fast ice continue to drift southwestward. Around the islands of Rauer Group (south of the Sørsdal Ice Shelf), only little fast ice remains.

The large fragments of iceberg D-15B continue to rotate anti-clockwise offshore. Smaller icebergs in the proximity of these two bergs indicate further instability of the bergs and ongoing break-up.

Figure 3 shows a high-resolution visible scene off the Vestfold Hills.

Thin clouds obscure the sea surface offshore Davis Station, but off the Sørsdal Ice Shelf, only small areas of strips and patches of melting sea ice are found and icebergs are drifting within 10 km to 15 km of the shore.

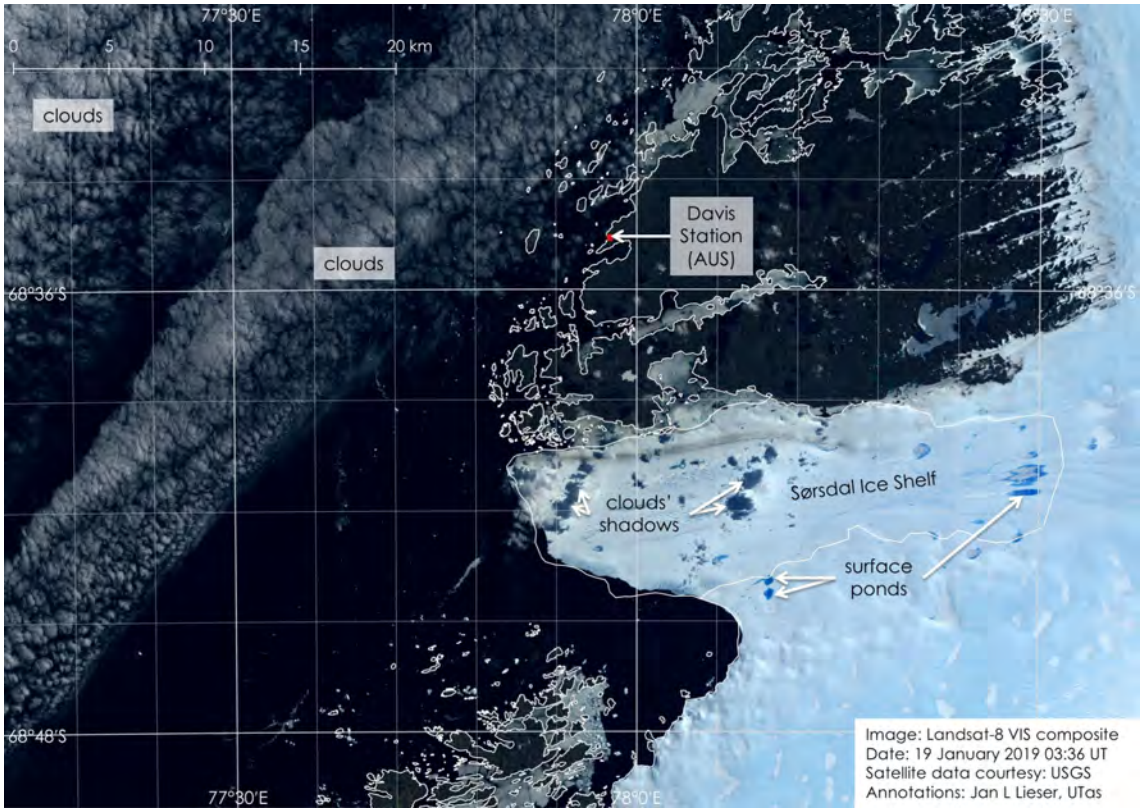

Figure 3: *Landsat-8 VIS composite acquired 19/01/2019 at 03:36 UT and provided by USGS.*

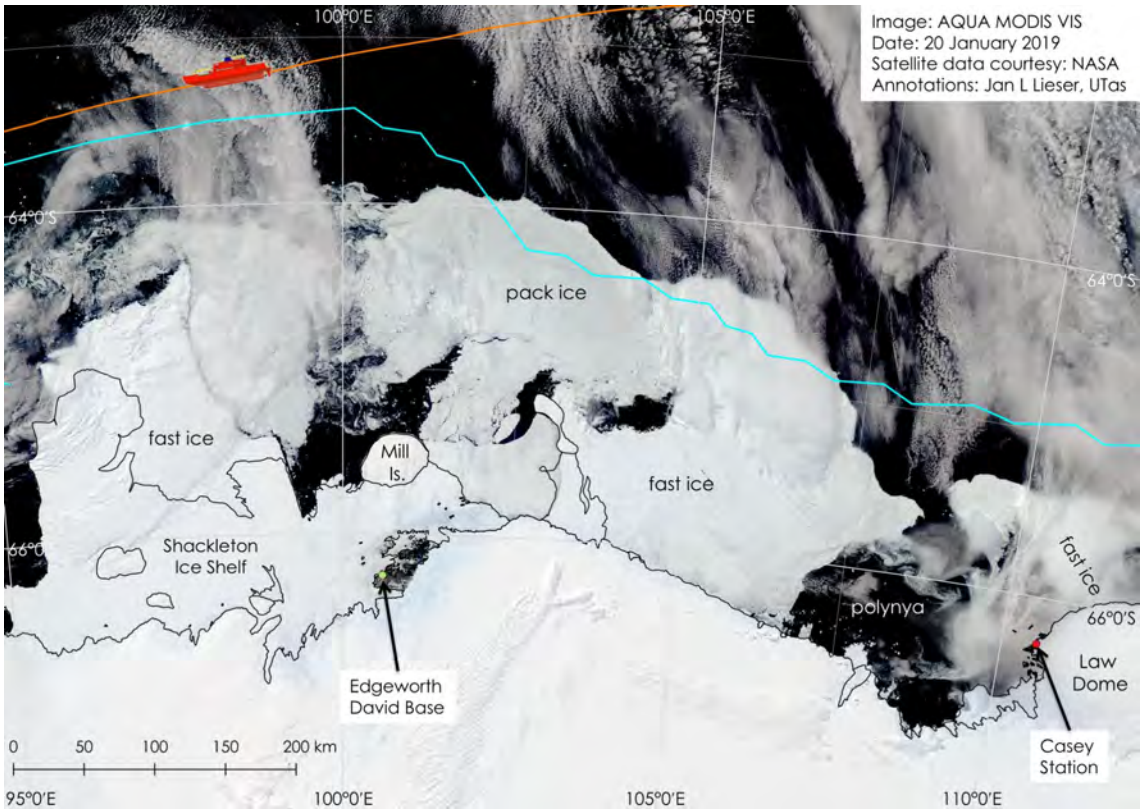

Figure 4: *AQUA MODIS VIS composite acquired 20/01/2019 and provided by NASA.*

Knox Coast

Figure 4 shows a visible scene off Knox Coast between the Shackleton Ice Shelf and Law Dome. In the northwest, the recent cruise track of RSV *Aurora Australis* is given by an orange line. The median sea-ice extent for January is marked by the cyan line.

In the Bunger Hills (south of Mill Island), the visible data suggest that some lakes of the northeastern part of the hills have open water now. In the southwest however, the location of Edgeworth David Base appears to be still covered by ice.

Sea Ice Report #04.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
22/01/2019

Ross Sea

Figure 1 shows a composite of SAR and visible data of the northwestern Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light blue (up until 21/01/2019 23:00 UT). Areas of sea-ice presence (where positively identifiable) are outlined by a yellow line. One large iceberg is marked by a pink circle.

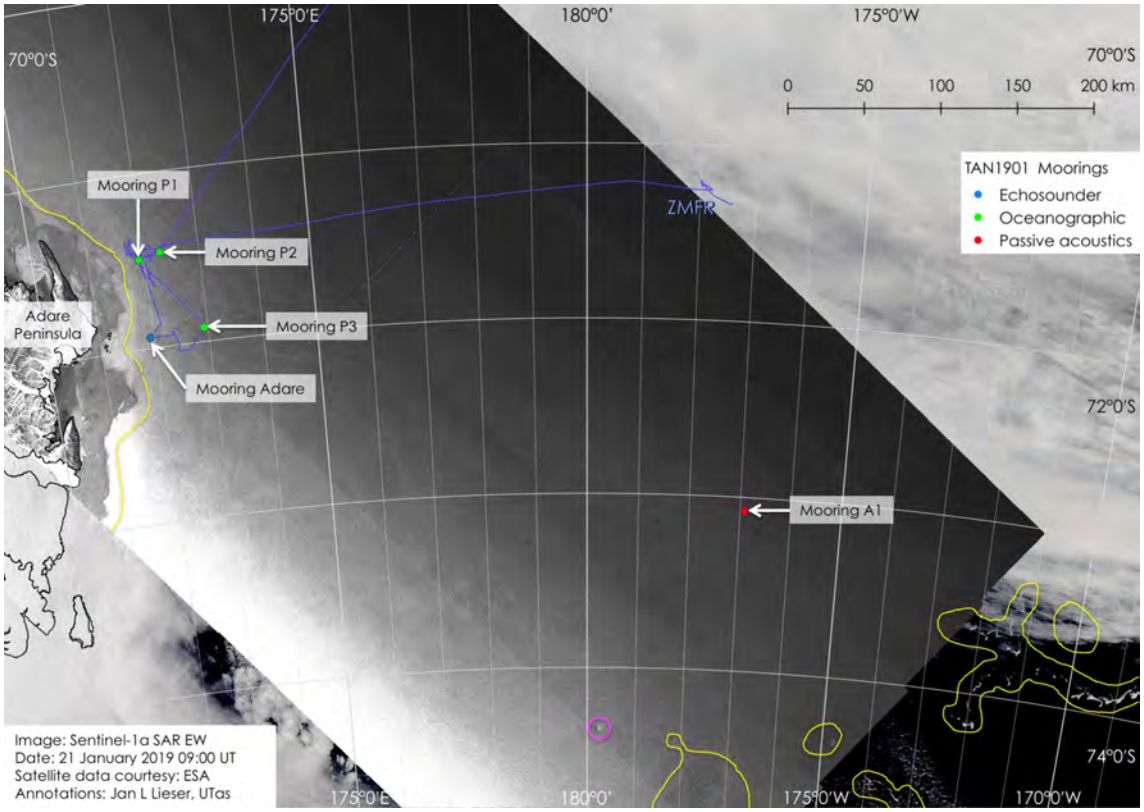

Figure 1: *Sentinel-1a SAR EW data (western swath) acquired 21/01/2019 at 09:00 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired 21/01/2019 and provided by NASA.*

All marked mooring locations are free of sea ice, however in the entire region shown in Figure 1, icebergs and iceberg fragments can be present.

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Sea Ice Report #04.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
22/01/2019

Mawson Station

Figure 1 shows a very high-resolution (10 m horizontal) visible scene of sea ice off Mawson Coast.

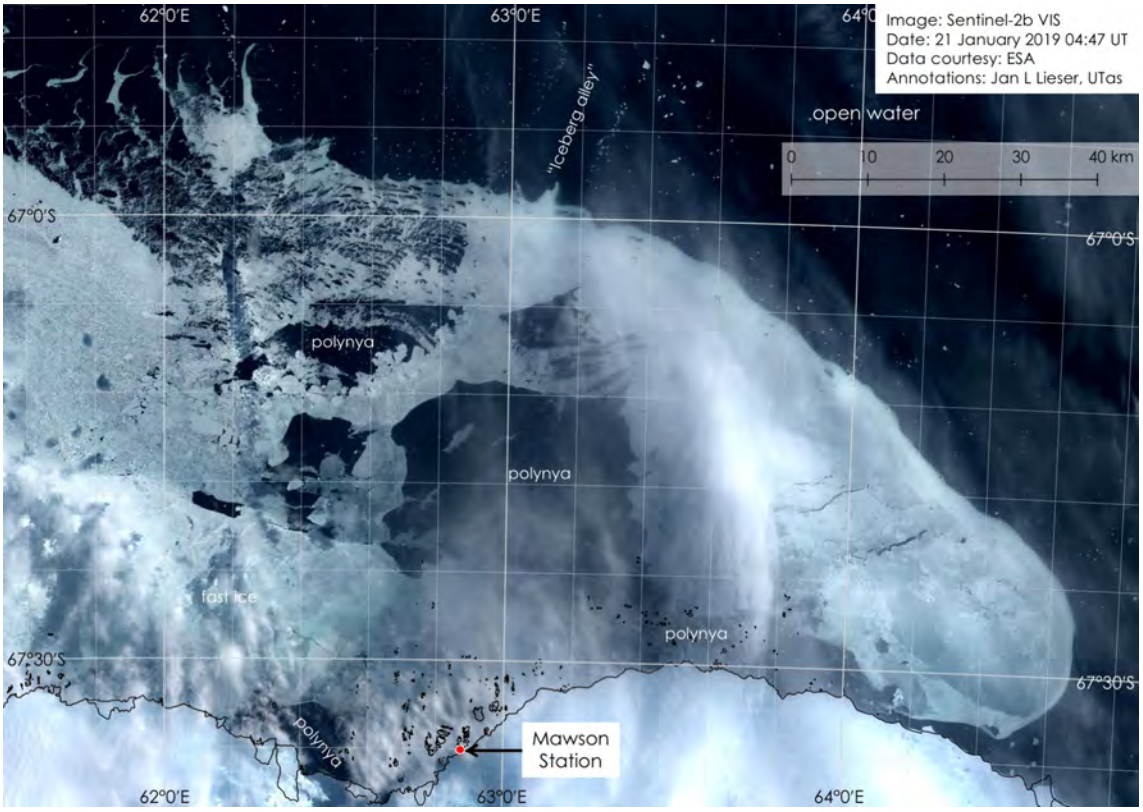

Figure 1: *Sentinel-2b VIS composite acquired 21/01/2019 at 04:47 UT and provided by USGS.*

Off Mawson Station, the shortest distance to the fast-ice edge directly north of the station has not changed significantly since 19/01/2019. But the further deterioration of near-shore fast ice is notable, where west of the station a large polynya has evolved and east of 63° 15' E (probably even further west than that), the fast-ice has detached from the coast.

Some grounded icebergs still hold the now drifting ex-fast ice locally, but further in-situ melting will reduce the ice cover.

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Figure 2 shows a SAR scene of the same frame as Figure 1 acquired roughly 12 hours after the Sentinel-2b data.

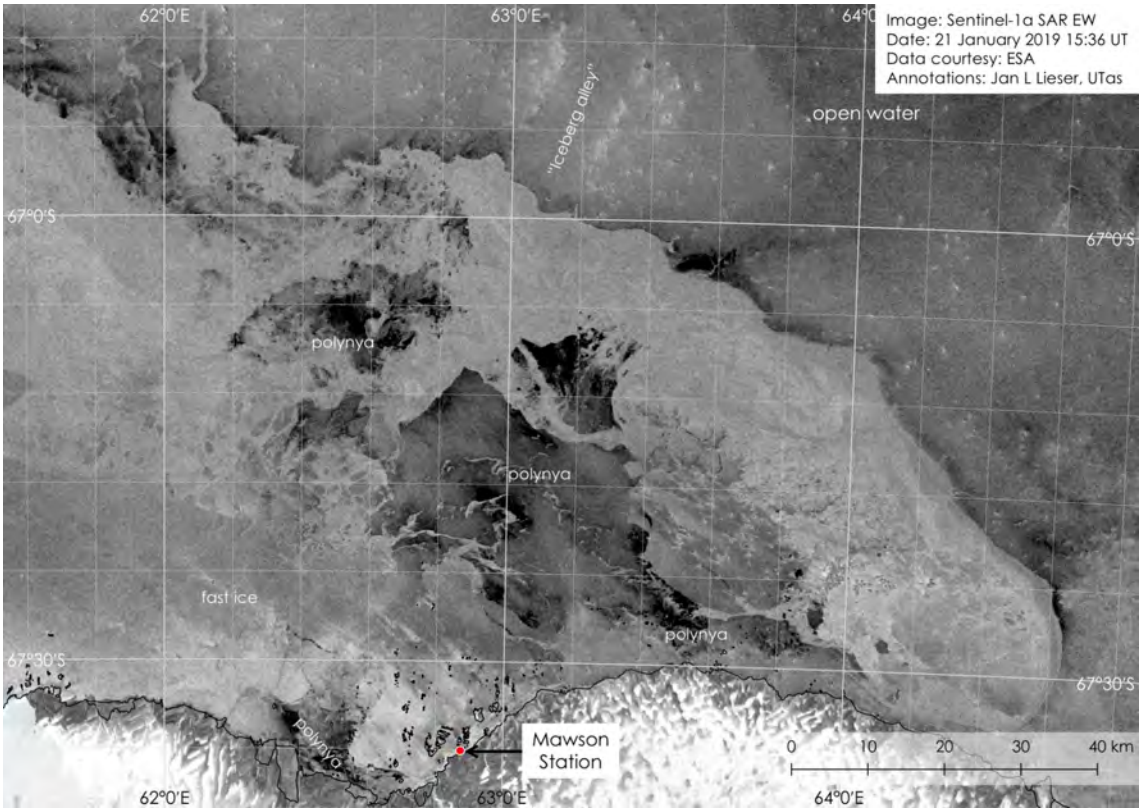

Figure 2: *Sentinel-1a SAR EW scene acquired 21/01/2019 at 15:36 UT and provided by Drift+Noise Polar Services.*

Sea Ice Report #04.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
23/01/2019

Mawson Station

Figure 1 shows a visible scene of sea ice off Mawson Coast.

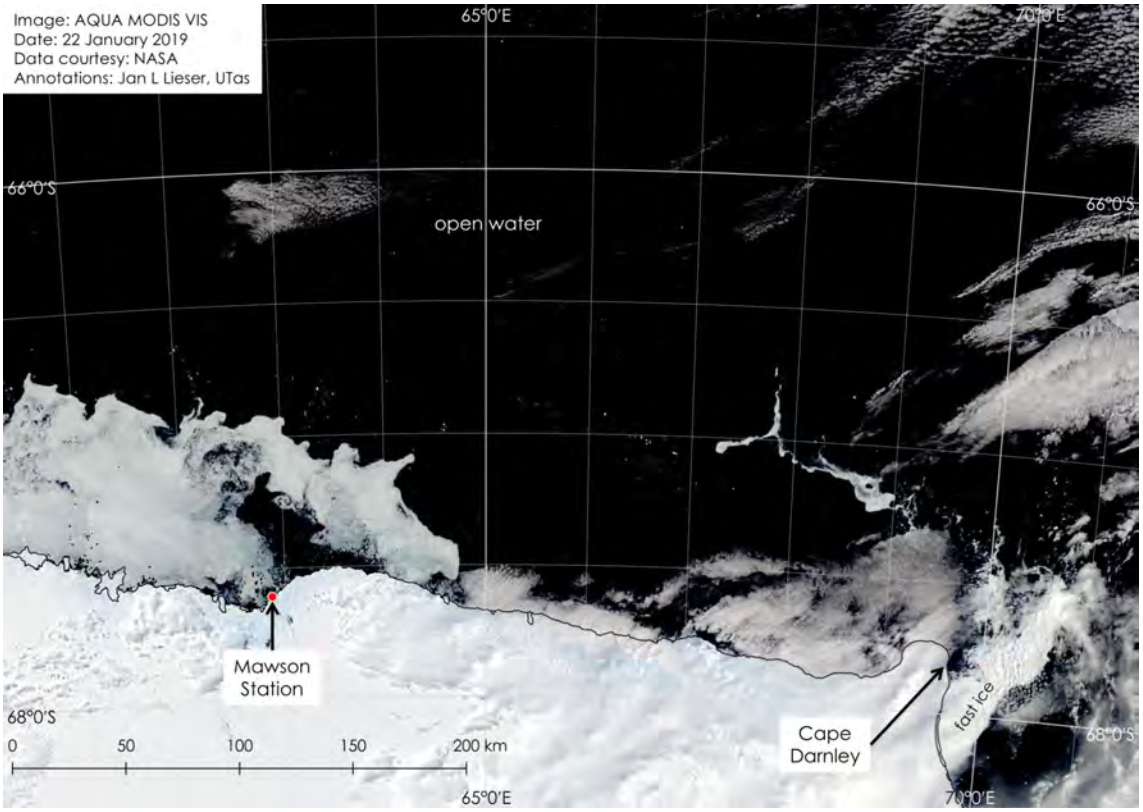

Figure 1: *AQUA MODIS VIS acquired 22/01/2019 and provided by NASA.*

Off Mawson Station, only very little fast ice remains north of the station. West of the station, a large polynya is widening. To the east, fast-ice has detached from the coast and is in an advanced state of decay.

Northwest of Cape Darnley, a spit-shaped patch of ex-fast ice originating from the fast ice south of the cape is floating freely and melting.

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Davis Station

Figure 2 shows a visible scene of Prydz Bay with an overlay of SAR data in the northeast.

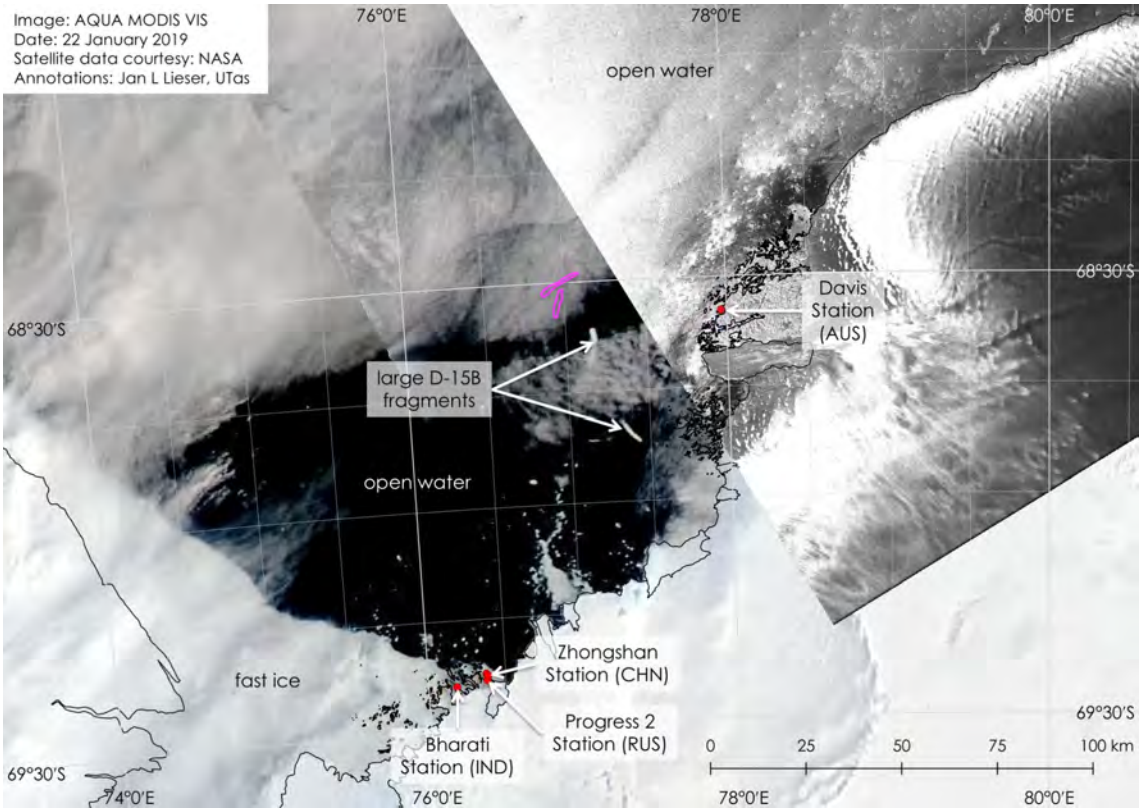

Figure 2: *AQUA MODIS VIS scene acquired 22/01/2019 and provided by NASA; overlay of Sentinel-1a SAR EW scene acquired 22/01/2019 at 14:39 UT and provided by PolarView.*

Around the Vestfold Hills and the Rauer Group, only very little fast ice remains and small fragments of ex-fast ice are melting offshore. Near shore, grounded and free floating icebergs are present. Two large fragments of iceberg D-15B are not spinning in close proximity anymore, but still show rotational movements while drifting southward.

Southern Prydz Bay is still covered by fast ice, but the northern part of the Larsemann Hills (home of Zhongshan Station, Progress-2 Station and Bahrati Station) is largely free of fast ice.

Sea Ice Report #04.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
24/01/2019

Ross Sea

Figure 1 shows a SAR scene of the northern Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light blue (up until 24/01/2019 01:30 UT). Punch holes along 180° longitude are a data processing artefact.

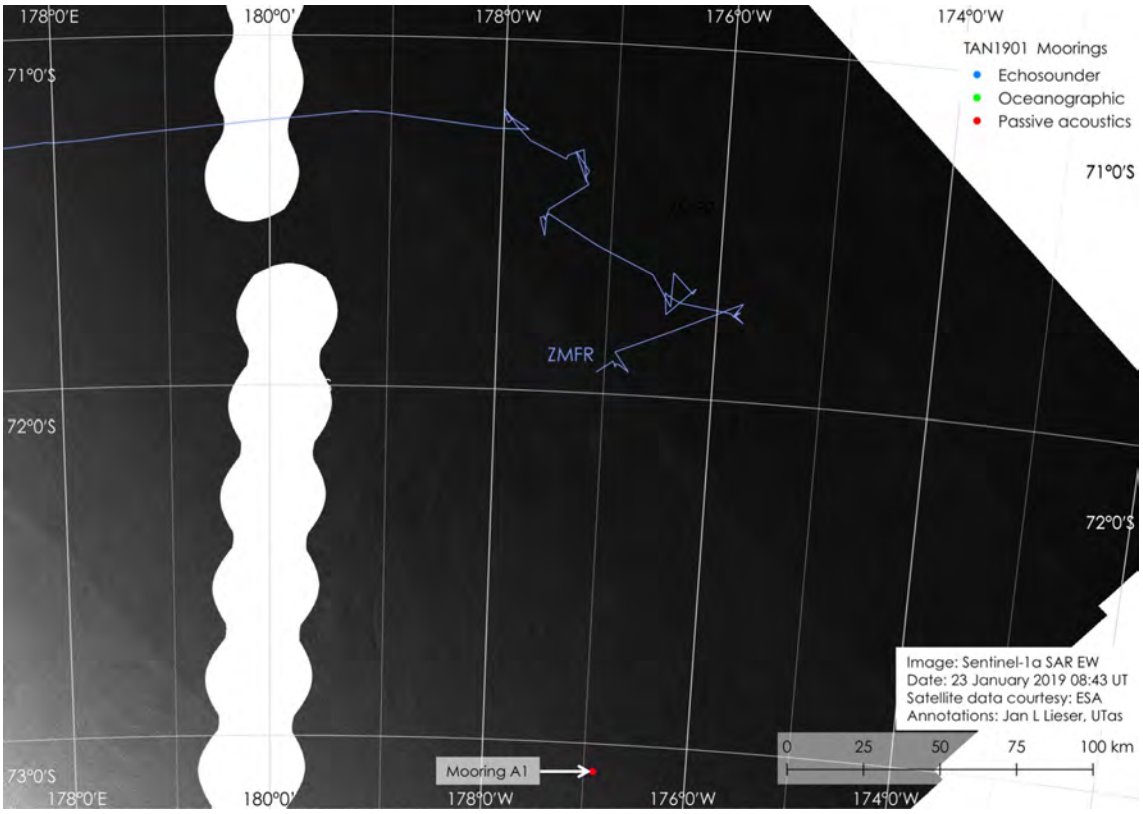

Figure 1: *Sentinel-1a SAR EW data acquired 23/01/2019 at 08:43 UT and provided by PolarView.*

While the frame of Figure 1 is generally free of any sea ice and large icebergs, icebergs of less than less 50 m waterline length (defined as the longest horizontal dimension the the water plane), bergy bits and glacial ice fragments may be present in the entire region.

*Disclaimer: *Every effort is made to ensure the data provided in this report are accurate at the date of publication; however the report is provided without warranty of any kind. The figures and charts provided in this report are intended only as a guide to ice conditions and are not suitable for navigation.*

Sea Ice Report #04.7/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
24/01/2019

D'Urville Sea

Figure 1 shows a sea-ice concentration chart of D'Urville Sea and the northwestern Ross Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given in blue (up until 24/01/2019 00:30 UT).

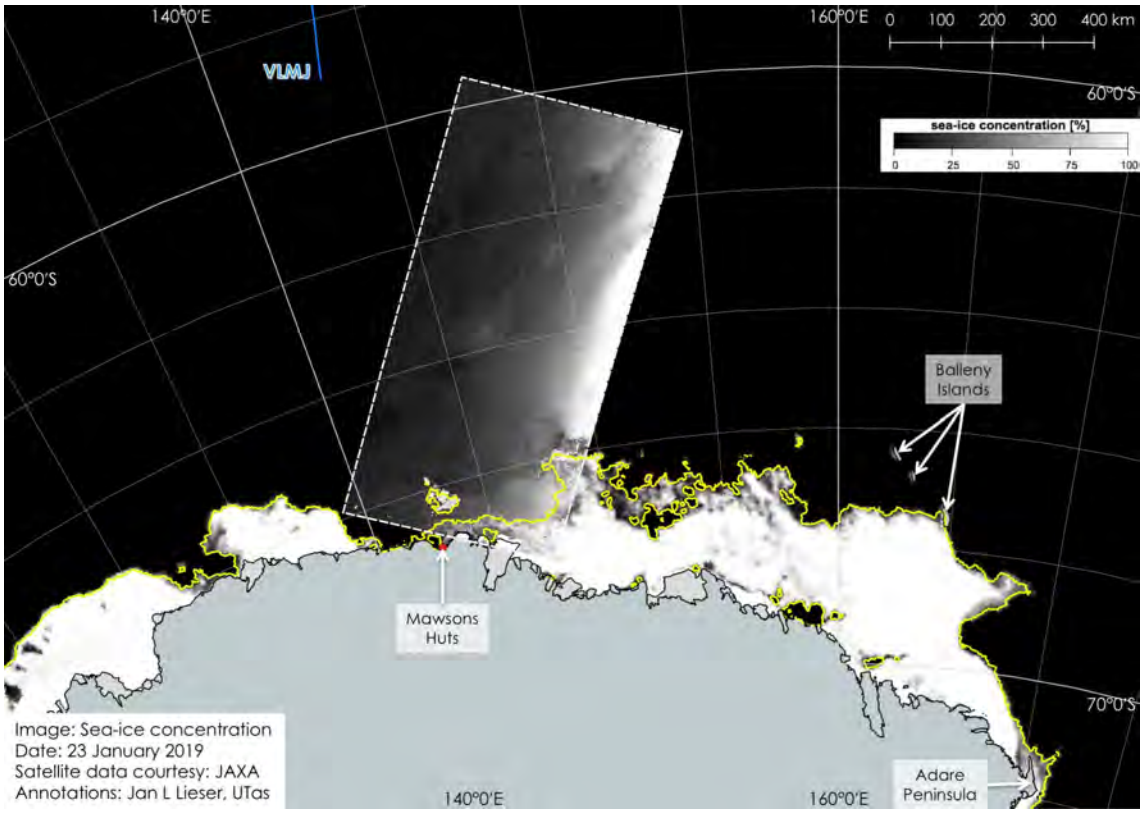

Figure 1: *Sea-ice concentration data acquired 23/01/2019 and provided by ICDC, Universität Hamburg; Overlay of a Sentinel-1a SAR EW swath (outlined by a dashed, white frame) acquired on 23/01/2019 at 18:26 UT and provided by PolarView.*

The sea-ice edge (based on passive microwave data) is marked by a yellow line. The northern two of the Balleny Islands are free of sea ice.

Large and small icebergs, and bergy bits may be present in the entire region.

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Sea Ice Report #04.8/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
24/01/2019

Cooperation Sea

Figure 1 shows a SAR scene of Cooperation Sea. The cruise track of RSV *Aurora Australis* (callsign: VNAA) is given in orange (up until 24/01/2019 03:45 UT). The sea-ice edge (based on passive microwave data) is marked by a yellow line.

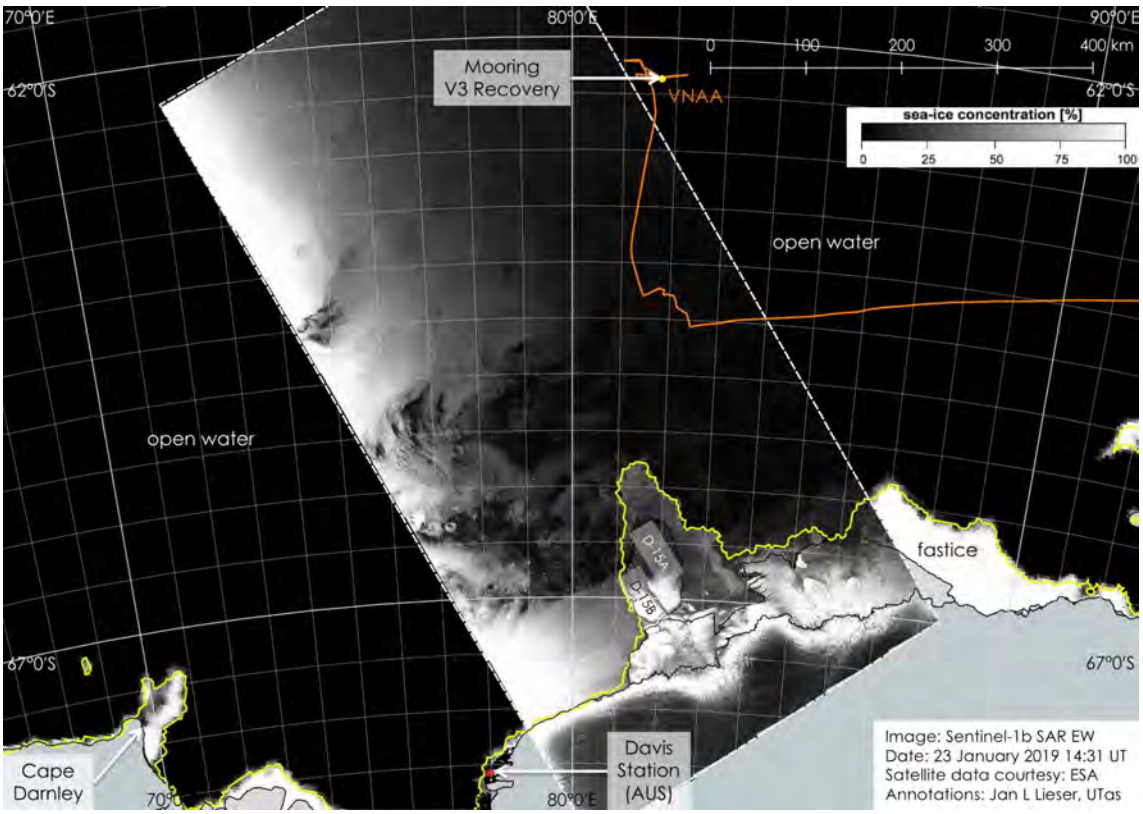

Figure 1: *Sentinel-1b SAR EW swath (outlined by a dashed, white frame) acquired on 23/01/2019 at 14:31 UT and provided by PolarView; Background of sea-ice concentration data acquired 23/01/2019 and provided by ICDC, Universität Hamburg.*

Many large and small icebergs can be identified in the SAR data. More icebergs and bergy bits may be present in the entire region. North and east of the D-15 icebergs, fast ice breaking up and strips and patches of ex-fast ice are melting in the vicinity.

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Davis Station

Figure 2 shows a SAR scene off Davis Station. The locations of two large D-15B iceberg fragments on 22/01/2019 are marked by pink outlines.

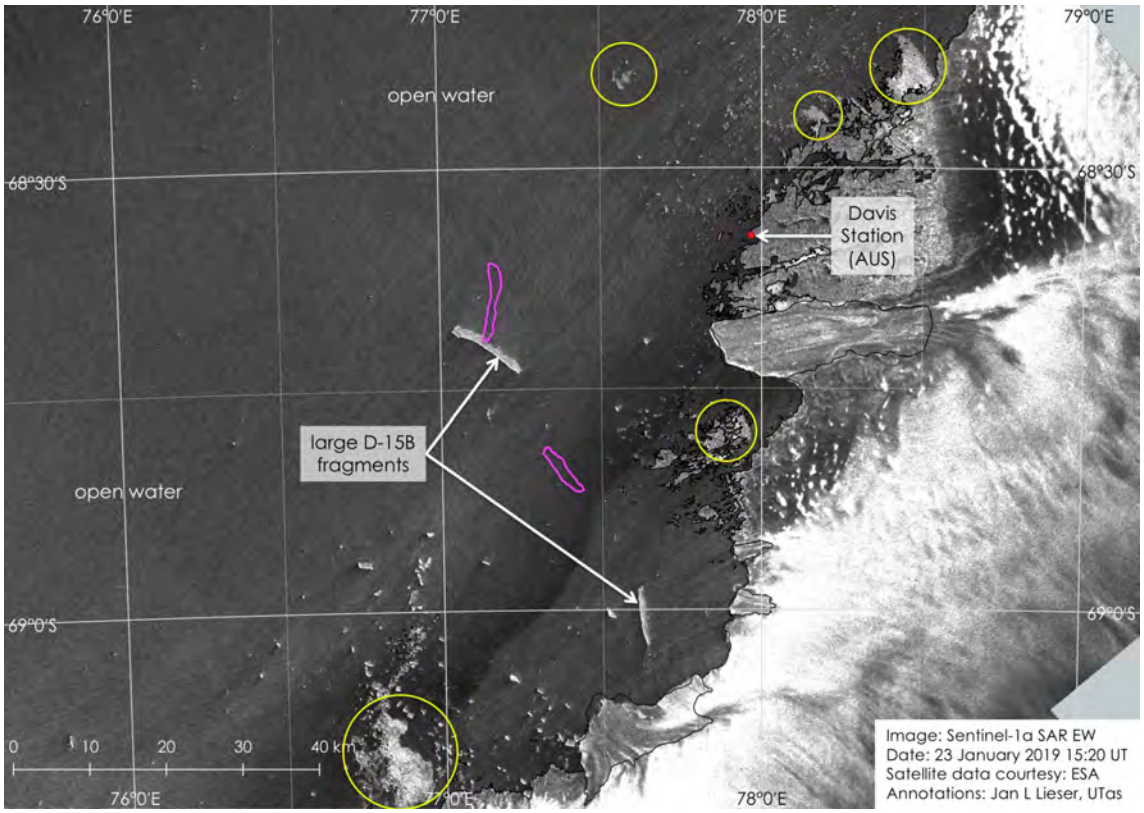

Figure 2: *Sentinel-1a SAR EW scene acquired on 23/01/2019 at 15:20 UT and provided by PolarView.*

Some pockets of breaking up fast ice (or ex-fast ice at 77° 34' E and 66° 23' S) are marked by yellow circles.

Nearshore, large and small icebergs can be identified in the SAR data, some of them are drifting, some are grounded.

Sea Ice Report #04.9/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
25/01/2019

Mawson Station

Figure 1 shows a SAR scene off Mawson Station.

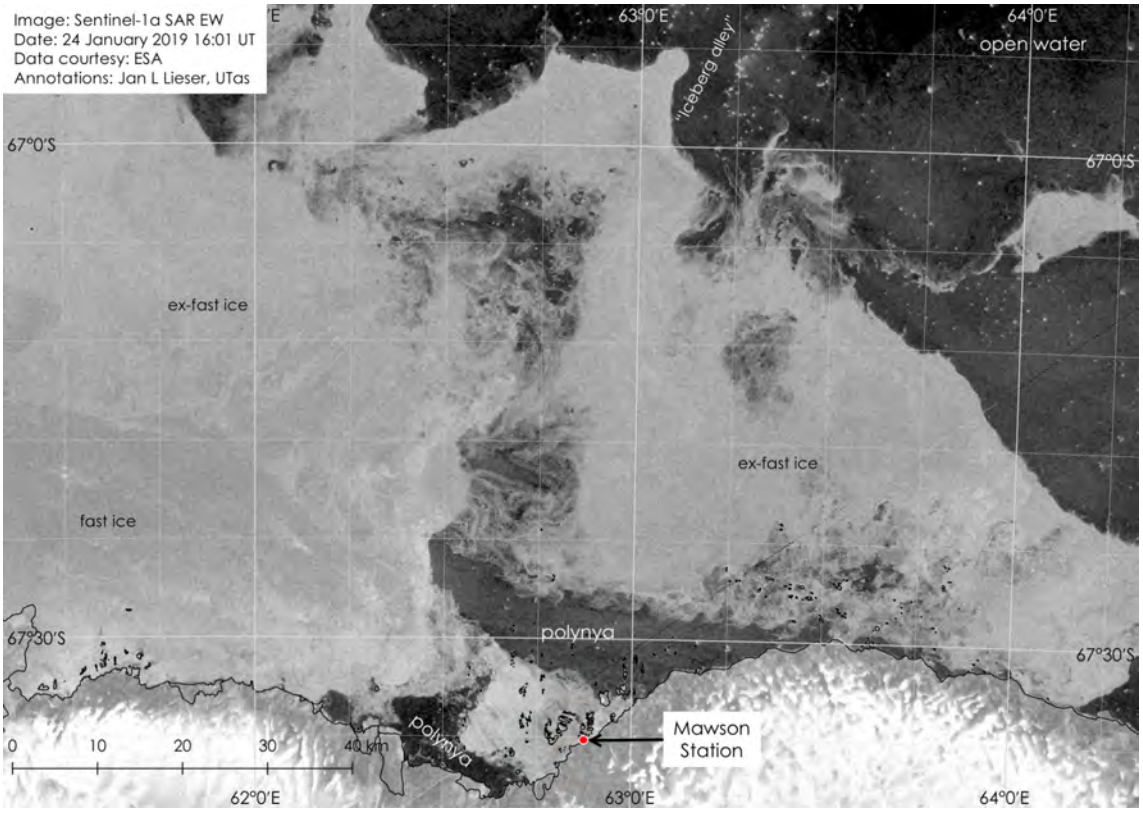

Figure 1: *Sentinel-1a SAR EW scene acquired on 24/01/2019 at 16:01 UT and provided by Drift+Noise Polar Services.*

Fast ice is deteriorating between the station and the so-called Iceberg Alley. Not many large floes can be identified in the matrix of sea-ice, which appears highly dynamic. Strips and patches of sea ice can be seen floating freely north of the polynya north of Mawson Station and off the sea-ice edge.

Figure 2 shows a visible scene of the same frame as Figure 1.

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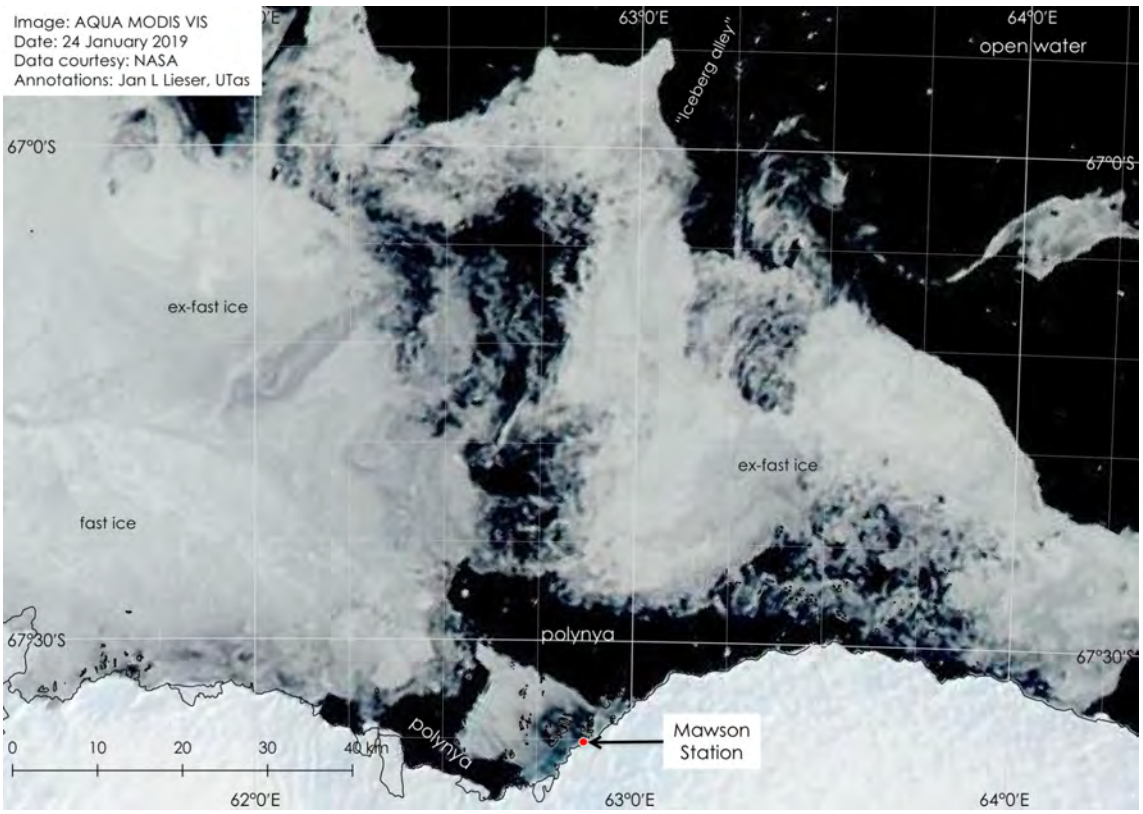

Figure 2: *AQUA MODIS VIS scene acquired on 24/01/2019 and provided by NASA.*

South of 67° 15' S, the extent of apparent open water in the visible data does not compare to the SAR data, because of different radiometric properties of thin, decaying ice in the SAR versus the visible part of the electromagnetic spectrum, and because of the different horizontal resolution of the two sensors (40 m of the SAR vs. 250 m of the MODIS instrument). This way, the visibly dark ocean may appear to shine through thinning sea ice, while the SAR still records ice-like scatter of the surface.

Sabrina Coast

Figure 3 shows a SAR scene of the northern end of the Moscow University Ice Shelf.

Off Henry Islands and Chick Island, fast ice has now broken away from the coast. One large ex-fast ice floe can be identified northwest of Chick Island.

Iceberg B-39 is crossing 66° 18' S southward in the so-called Dalton Polynya, west of the Dalton Iceberg Tongue.

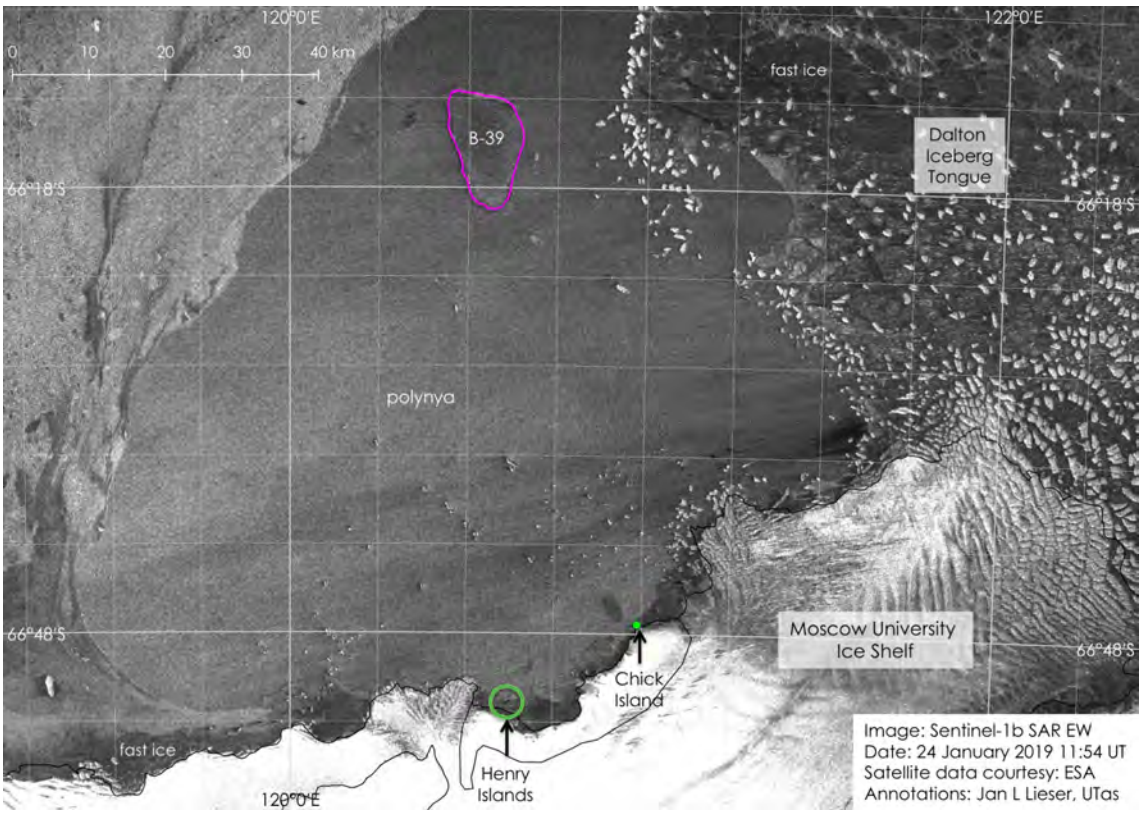

Figure 3: *Sentinel-1b SAR EW swath acquired on 24/01/2019 at 11:15 UT and provided by PolarView.*

Sea Ice Report #05.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
29/01/2019

D'Urville Sea

Figure 1 shows a Synthetic Aperture RADAR (SAR) scene of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given in blue (up until 28/01/2019 23:30 UT).

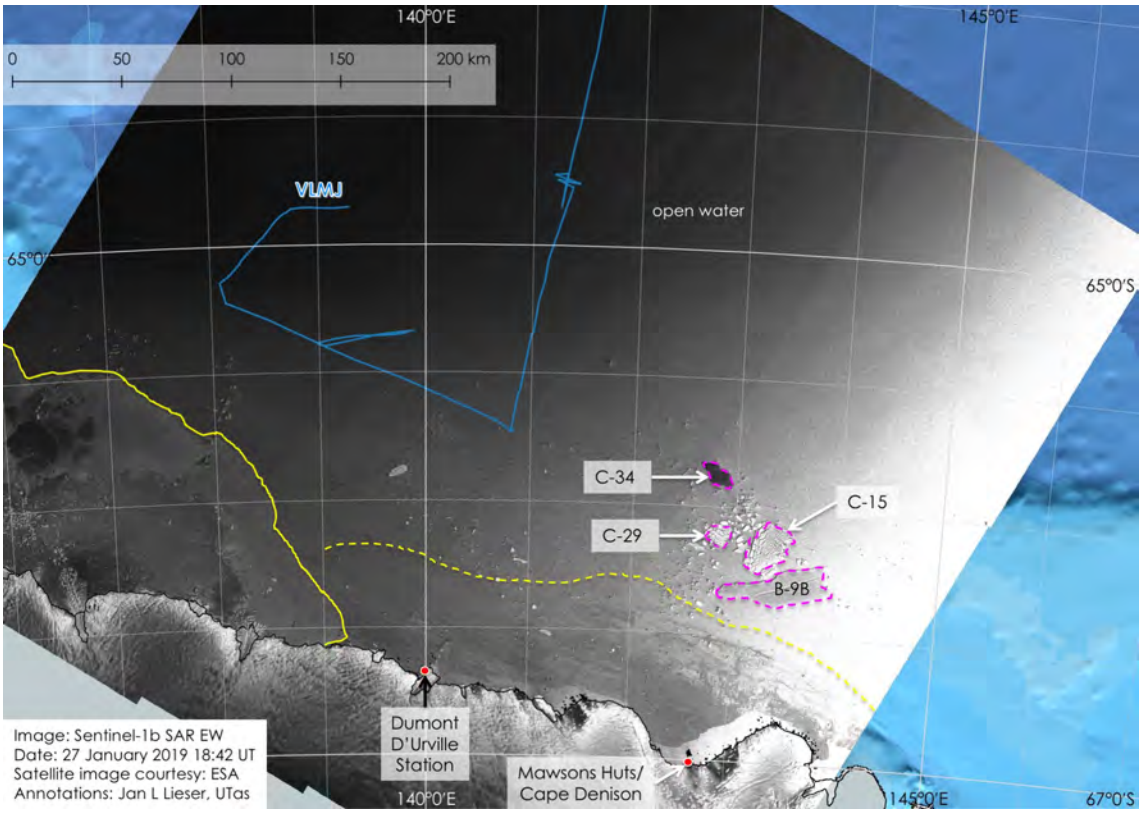

Figure 1: *Sentinel-1b SAR EW scene acquired on 27/01/2019 at 18:43 UT and provided by PolarView.*

The sea-ice edge is marked by a yellow line, which is dashed where strips and patches of sea ice (originating from the Mertz Ice Shelf region) are drifting nearshore.

A group of large, tabular icebergs is marked by dashed, pink outlines. More large and small icebergs, and bergy bits are present in the entire region.

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Sea Ice Report #05.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
29/01/2019

Ross Sea

Figure 1 shows a SAR scene of the northern Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light blue (up until 29/01/2019 03:30 UT). Punch holes along 180° longitude are a data processing artefact. Diagonal grey-shaded strips are owed to the sensing geometry of the RADAR.

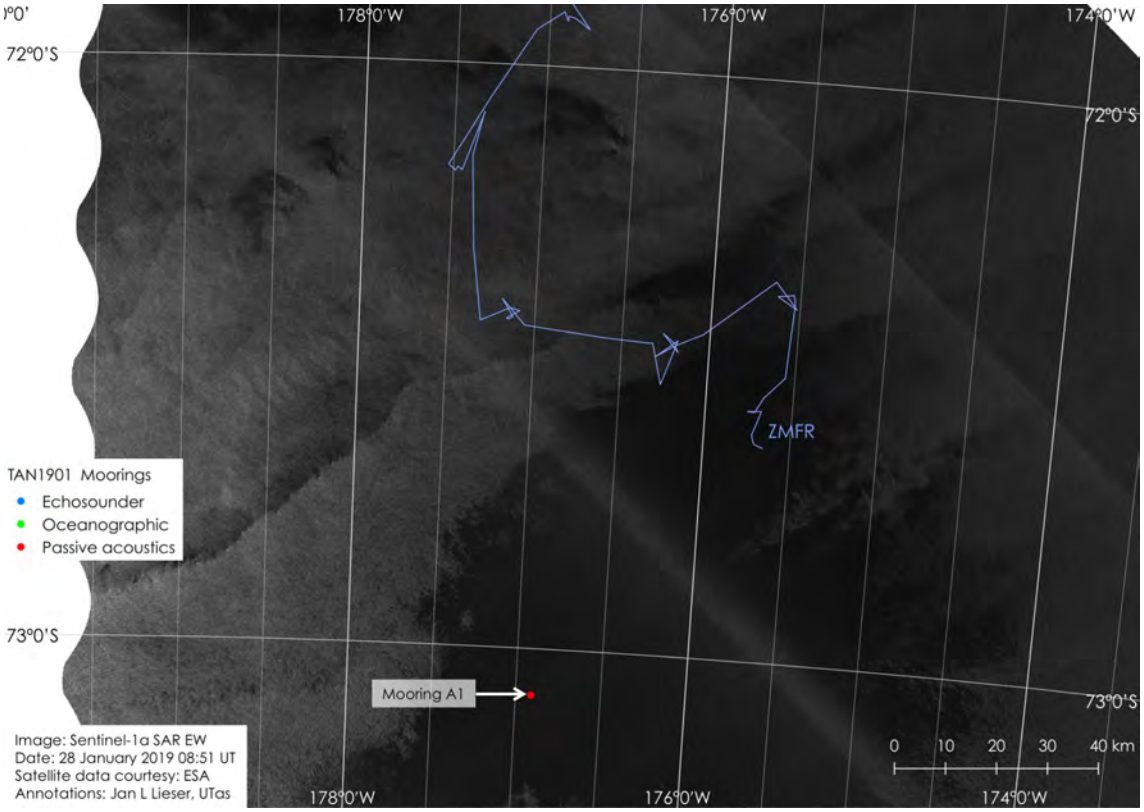

Figure 1: *Sentinel-1a SAR EW data acquired 28/01/2019 at 08:51 UT and provided by PolarView.*

While the frame given in Figure 1 remains generally free of any sea ice and large icebergs, icebergs of less than less 50 m waterline length, bergy bits and glacial ice fragments may be present in the entire region.

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Sea Ice Report #05.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
30/01/2019

Mawson Station

Figure 1 shows a high-resolution SAR scene off Mawson Station. The cruise track of RSV *Aurora Australis* (up until 29/01/2019 23:40 UT) is given by the orange line.

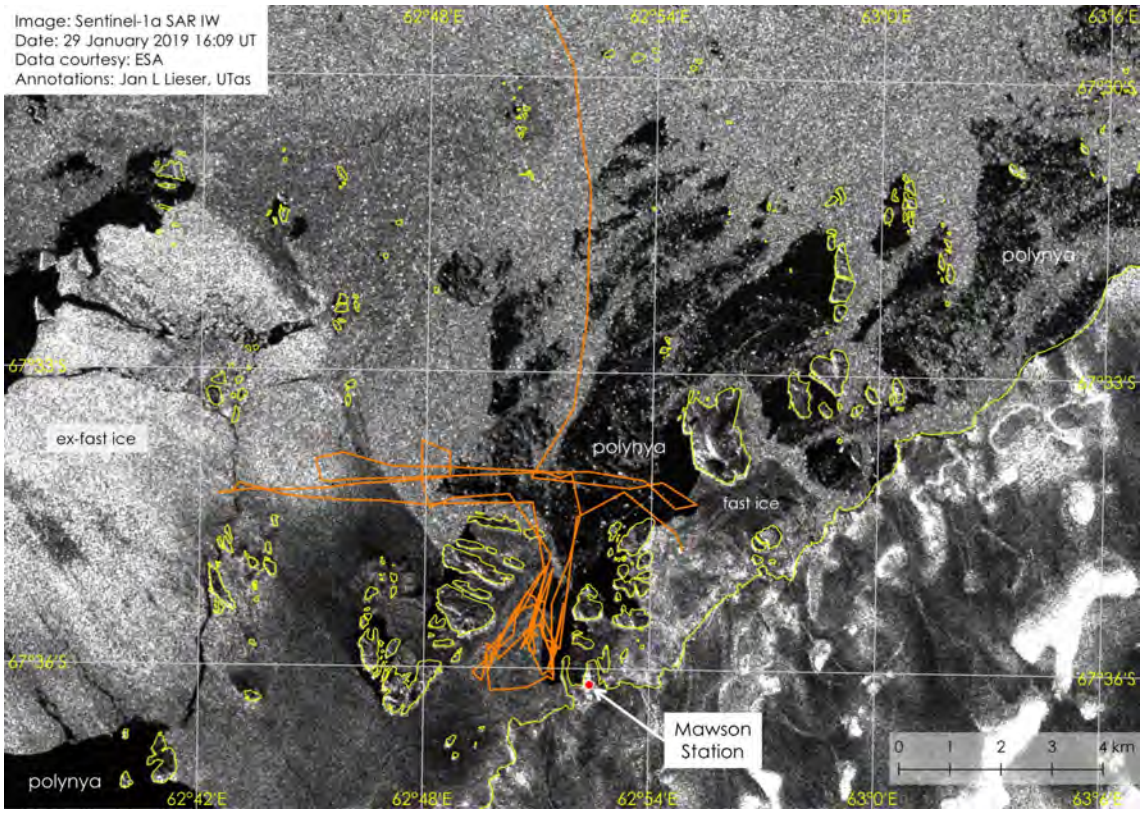

Figure 1: *Sentinel-1a SAR IW scene acquired on 29/01/2019 at 16:09 UT and provided by PolarView.*

North of the station, breaking up ex-fast ice can be seen drifting in the polynya. Along the coast northeast of the station, some fast ice remains shore-fast and west of the station, a few sheets of ex-fast ice are seen breaking up.

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Bunger Hills

Figure 2 shows a high-resolution visible scene of the Bunger Hills.

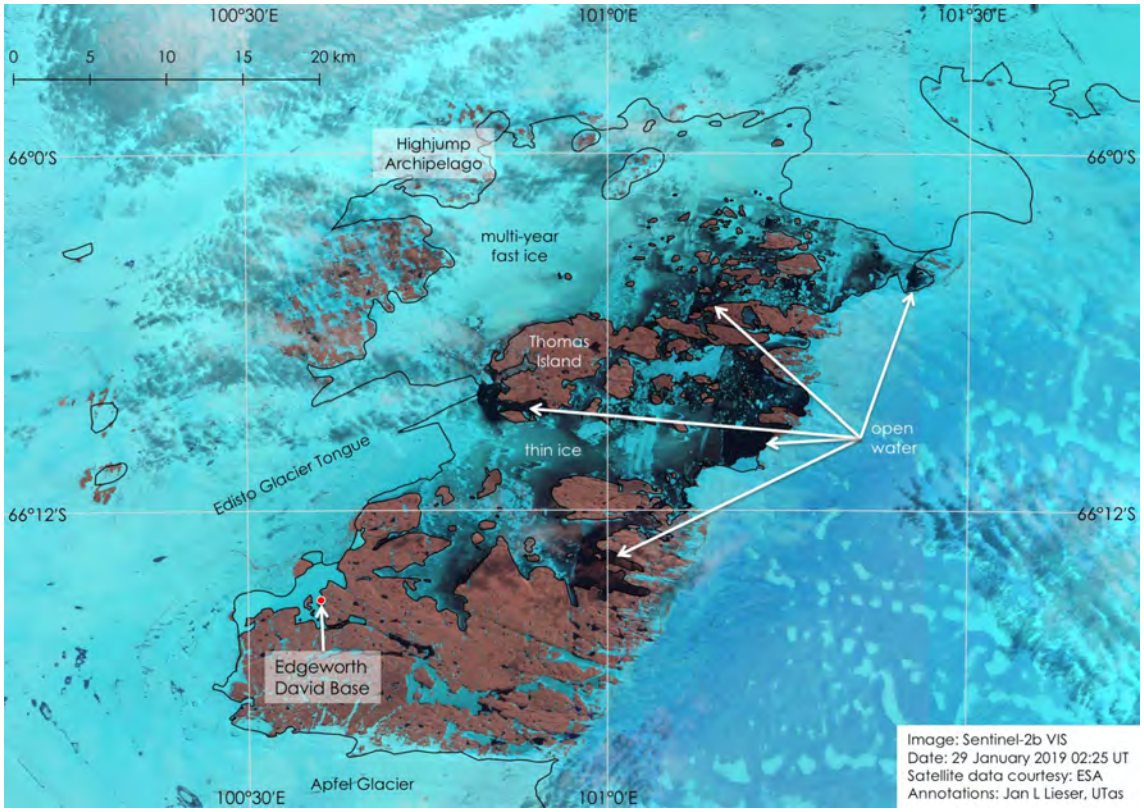

Figure 2: *Sentinel-2b visible scene acquired on 29/01/2019 at 02:25 UT and provided by USGS.*

In the northeastern part of the hills, fast ice is melting back and open water is identified in-between the rock outcrop. Such behaviour would not be typically expected before the summer season nears its end. The last time open water was reported by this service was at the end of February 2017 and into mid March of that year.

Off Edgeworth David Base, the fast ice appears currently still intact from above. But there are patches of open water south and southeast of the base in a valley between the hills.

D'Urville Sea

Figure 3 shows a SAR and visible data composite of southern D'Urville Sea.

Off Cape Denison, a dashed, yellow line marks the southern edge of ex-fast ice debris based on visible data (the data that complement the figure in the southwest) captured only a few hours hours before the SAR data. It highlights the dynamic nature of this decaying strip of sea ice, which originates from breaking up ex-fast ice east of the Mertz Ice Shelf.

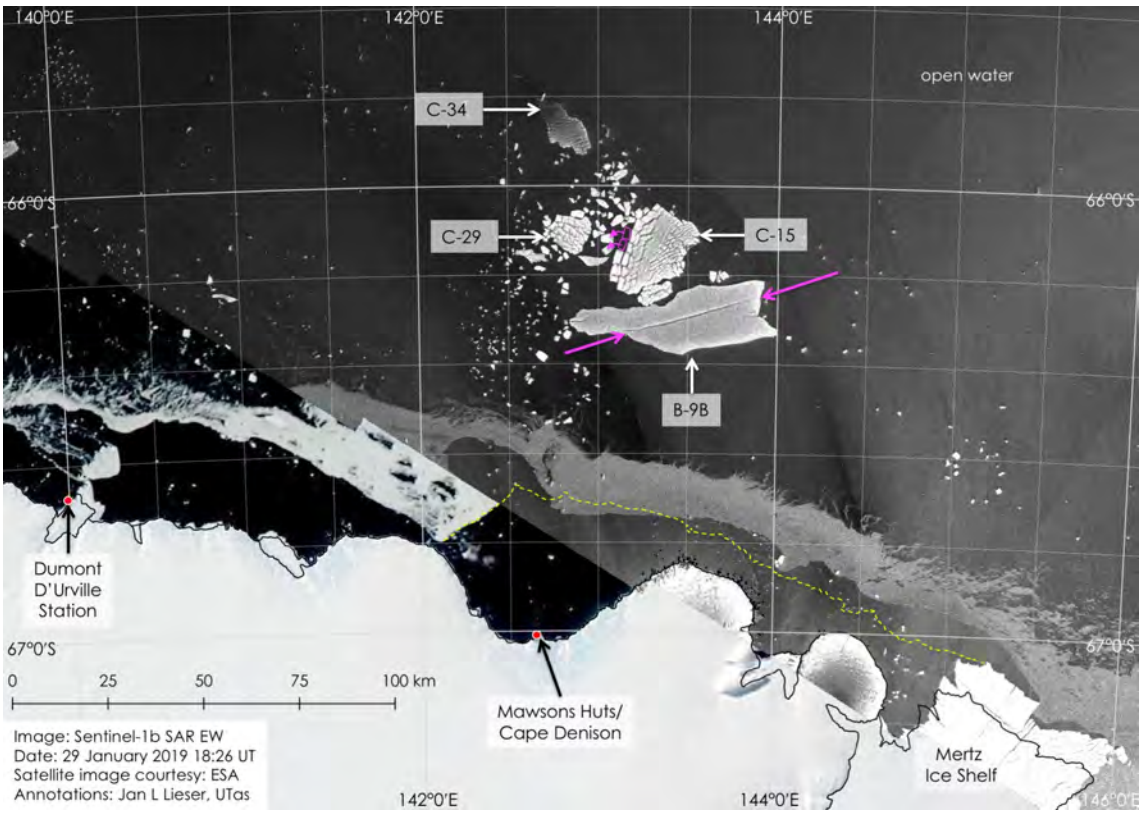

Figure 3: *Sentinel-1b SAR EW swath acquired on 29/01/2019 at 18:26 UT and provided by PolarView; complemented by AQUA MODIS VIS data acquired on 29/01/2019 and provided by NASA.*

The majority of the large, tabular icebergs north of Cape Denison are mobile, but icebergs C-15 and B-9B stay trapped between smaller, but grounded bergs. However, iceberg C-15 is shedding pieces off its side (two recent break-aways are marked with pink shapes at their original location on the western edge of the berg) and a crack along the long axis of iceberg B-9B appears to be developing and nearing the edges of the berg (marked by pink arrows). Smaller pieces of the those bergs might have a chance to escape from the region eastward or northward through gaps between grounded bergs.

Iceberg C-29 remains grounded and iceberg C-34 continues swivelling around its southern end.

Sea Ice Report #05.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
31/01/2019

Ross Sea

Figure 1 shows a sea-ice concentration chart of the Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in white (up until 31/01/2019 03:00 UT).

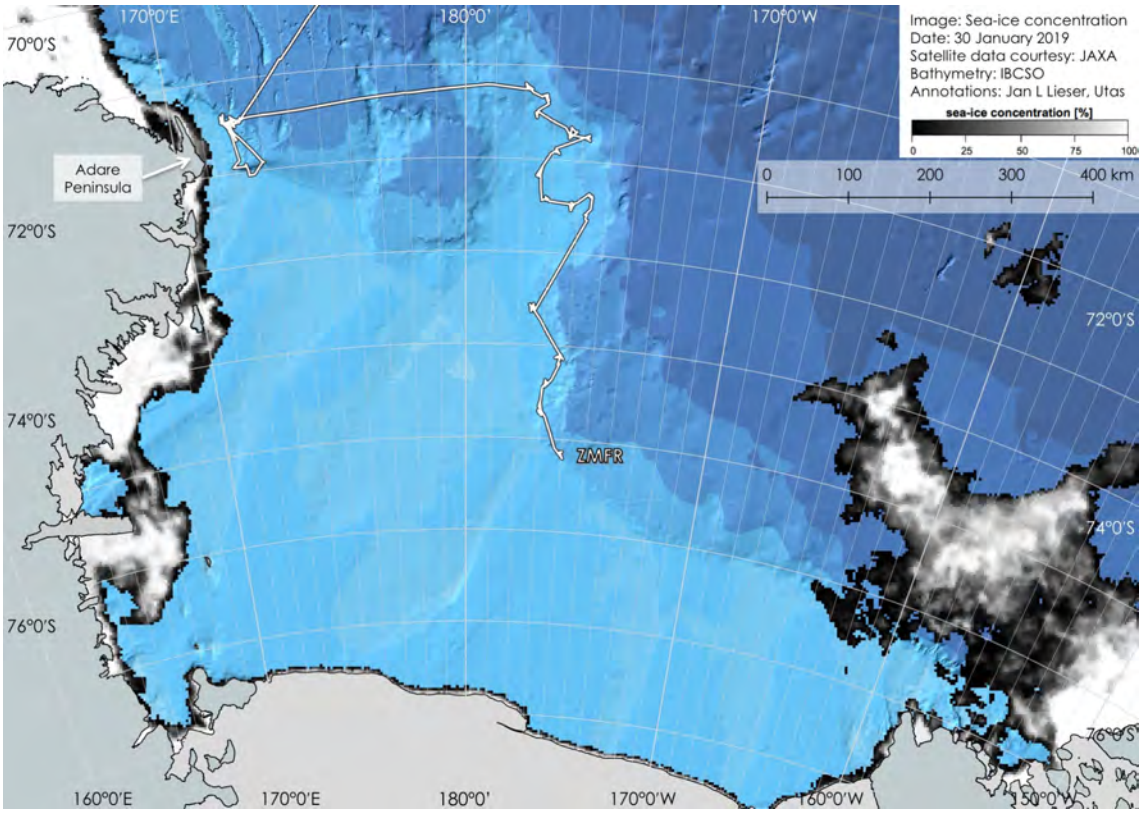

Figure 1: *Sea-ice concentration data acquired 30/01/2019 and provided by ICDC/Universität Hamburg.*

The central Ross Sea is free of sea ice (within the limits of the sea-ice concentration algorithm, which is 15% areal coverage in a 3.125 km × 3.125 km grid cell).

Large and small icebergs, bergy bits and glacial debris my be present in the entire region of Figure 1.

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Sea Ice Report #05.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
01/02/2019

Davis Station

Figure 1 shows a SAR scene off the Vestfold Hills. The locations of two large fragments of iceberg D-15B since 28/01/2019 (based on visible imagery) are marked by coloured shapes.

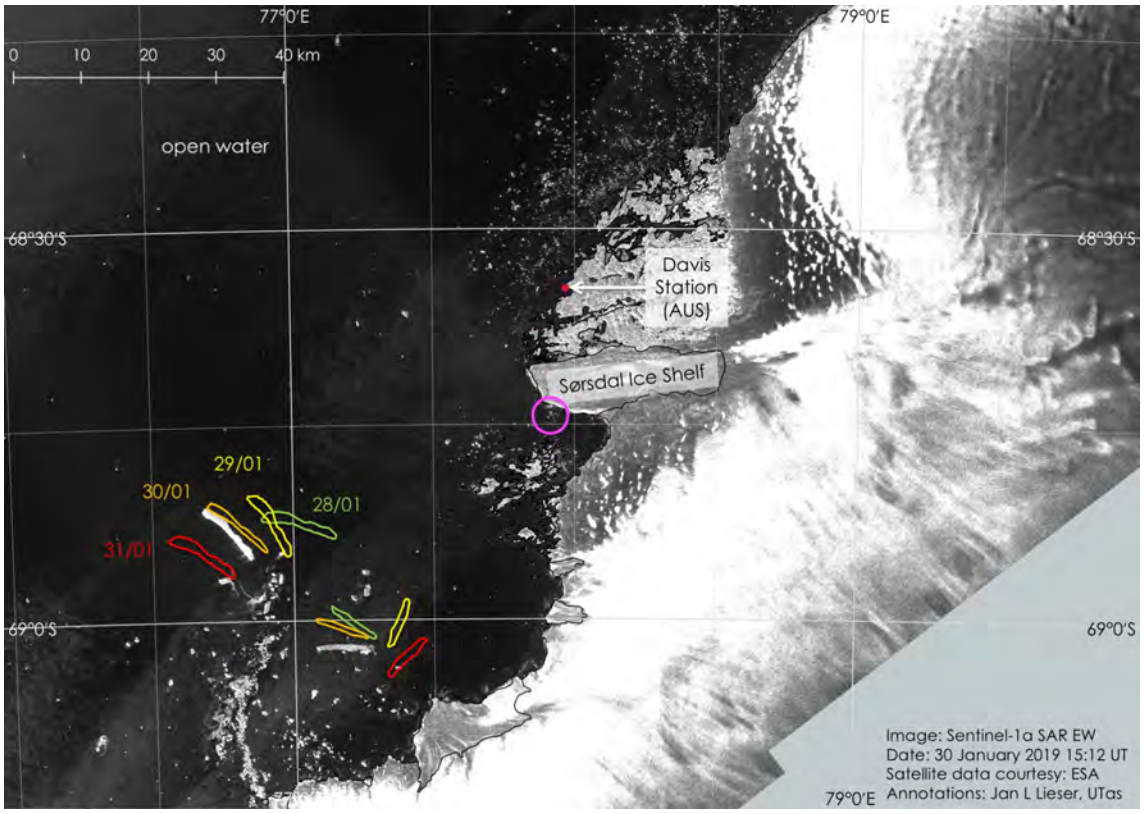

Figure 1: *Sentinel-1a SAR EW data acquired 30/01/2019 at 15:12 UT and provided by PolarView.*

Off the Vestfold Hills, a mixture of small and large icebergs and ex-fast ice debris can be seen. Off the Sørsdal Ice Shelf, a pink circle marks a location where presumed glacial debris is floating. This could be likely caused by a recent calving event off the face of the shelf.

The large fragments of iceberg D-15B continue to rotate anti-clockwise southwest of the Rauer Group.

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Figure 2 shows a high-resolution SAR scene off the Sørsdal Ice Shelf.

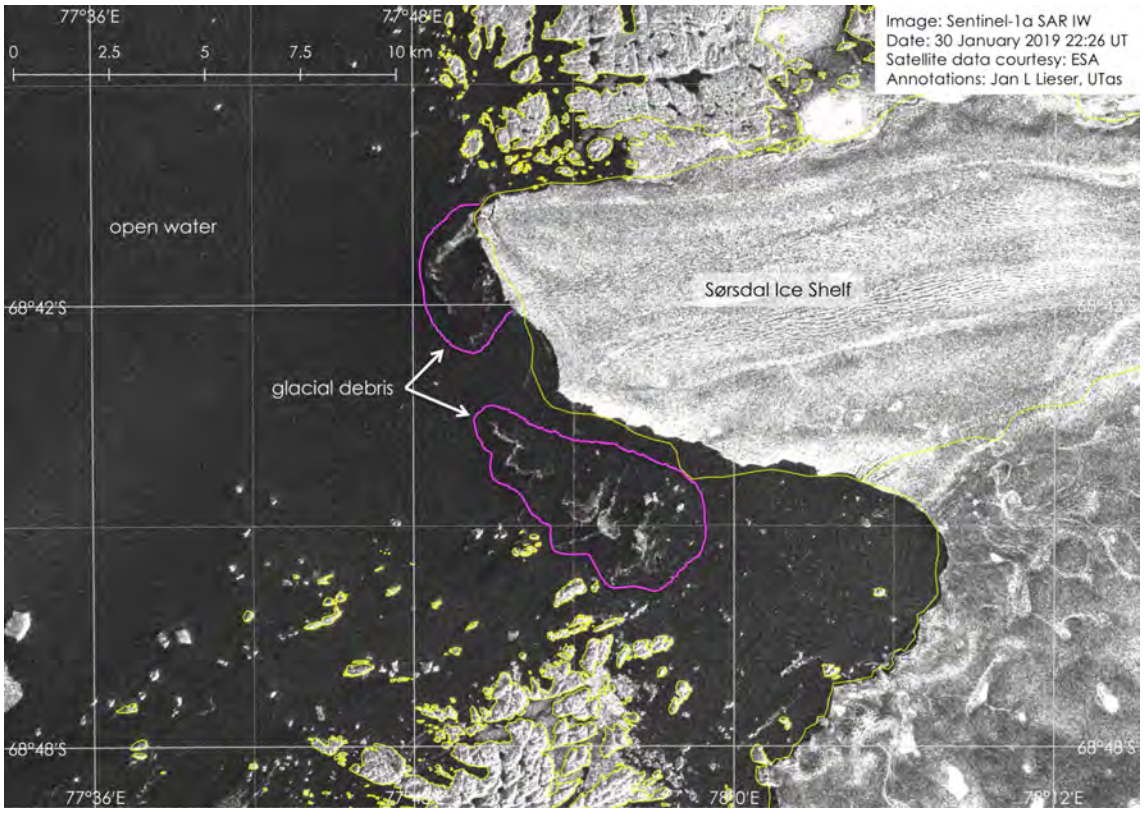

Figure 2: *Sentinel-1a SAR IW data acquired 30/01/2019 at 22:26 UT and provided by PolarView.*

Pink outlines mark the areas of above mentioned new glacial debris.

Sea Ice Report #05.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
01/02/2019

D'Urville Sea

Figure 1 shows a sea-ice concentration chart of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given in white (up until 01/02/2019 01:30 UT).

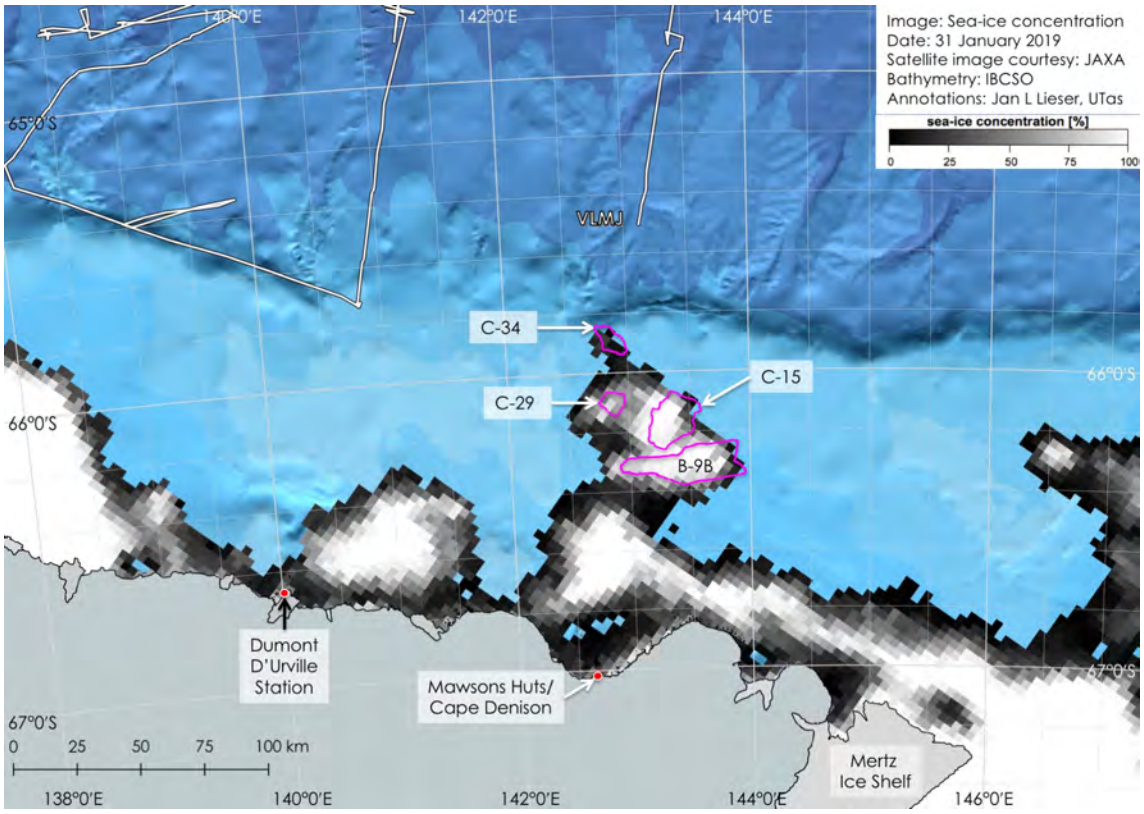

Figure 1: *Sentinel-1b SAR EW scene acquired on 27/01/2019 at 18:43 UT and provided by PolarView.*

North of the continental shelf slope, the waters are free of sea ice, but large and small icebergs, and bergy bits can be present in the entire region.

North of Cape Denison, a group of large, tabular icebergs is marked by pink outlines. Those bergs are surrounded by smaller icebergs, but are not sea ice although still interpreted as sea-ice concentration by the algorithm.

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Sea Ice Report #06.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/02/2019

Ross Sea

Figure 1 shows SAR scenes of the southeastern Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) is given in light-blue (up until 03/02/2019 23:00 UT).

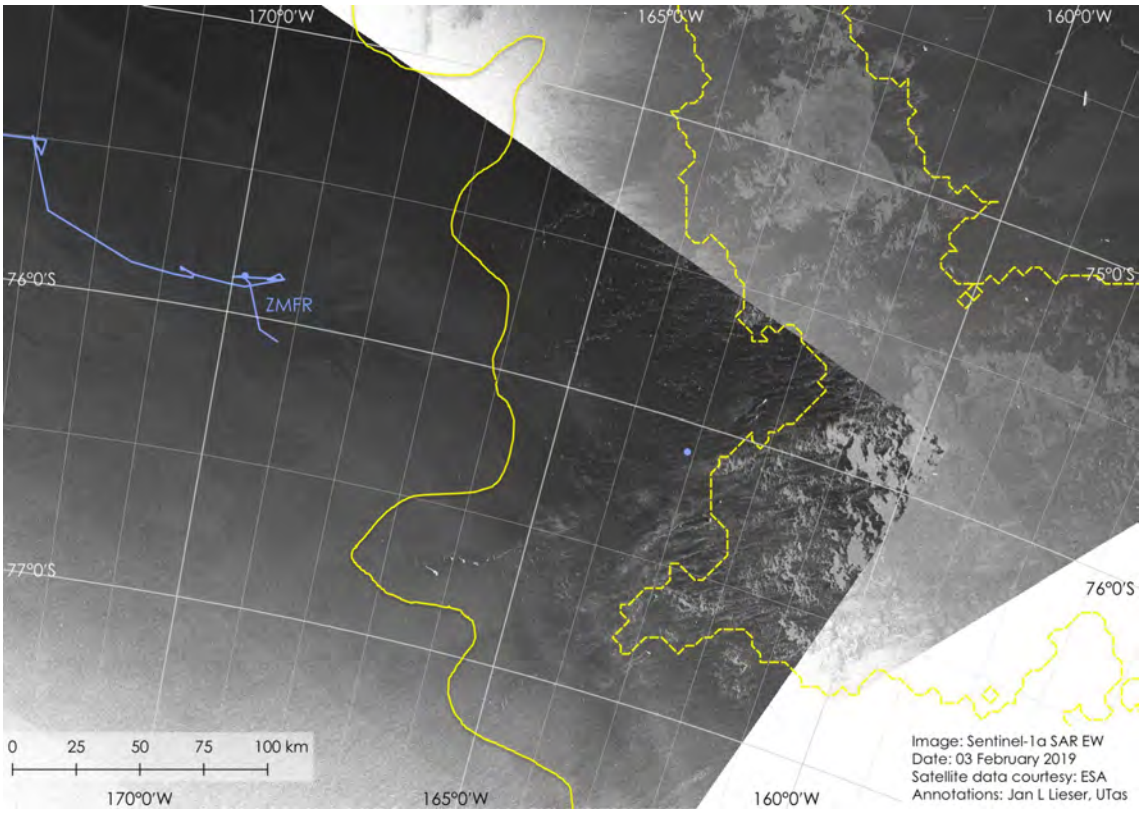

Figure 1: *Sentinel-1a SAR EW scenes; northeastern scene acquired 03/02/2019 at 08:02 UT and southwestern scene acquired 03/02/2019 at 09:39 UT and both provided by PolarView.*

Strips and patches of decaying sea ice can be seen east of a yellow scribble line in the figure. The dashed, yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 03/02/2019.
Large and small icebergs, bergy bits and glacial debris my be present in the entire region of Figure 1.

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Sea Ice Report #06.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
04/02/2019

D'Urville Sea

Figure 1 shows a Synthetic Aperture RADAR (SAR) scene of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given in blue (up until 04/02/2019 01:30 UT).

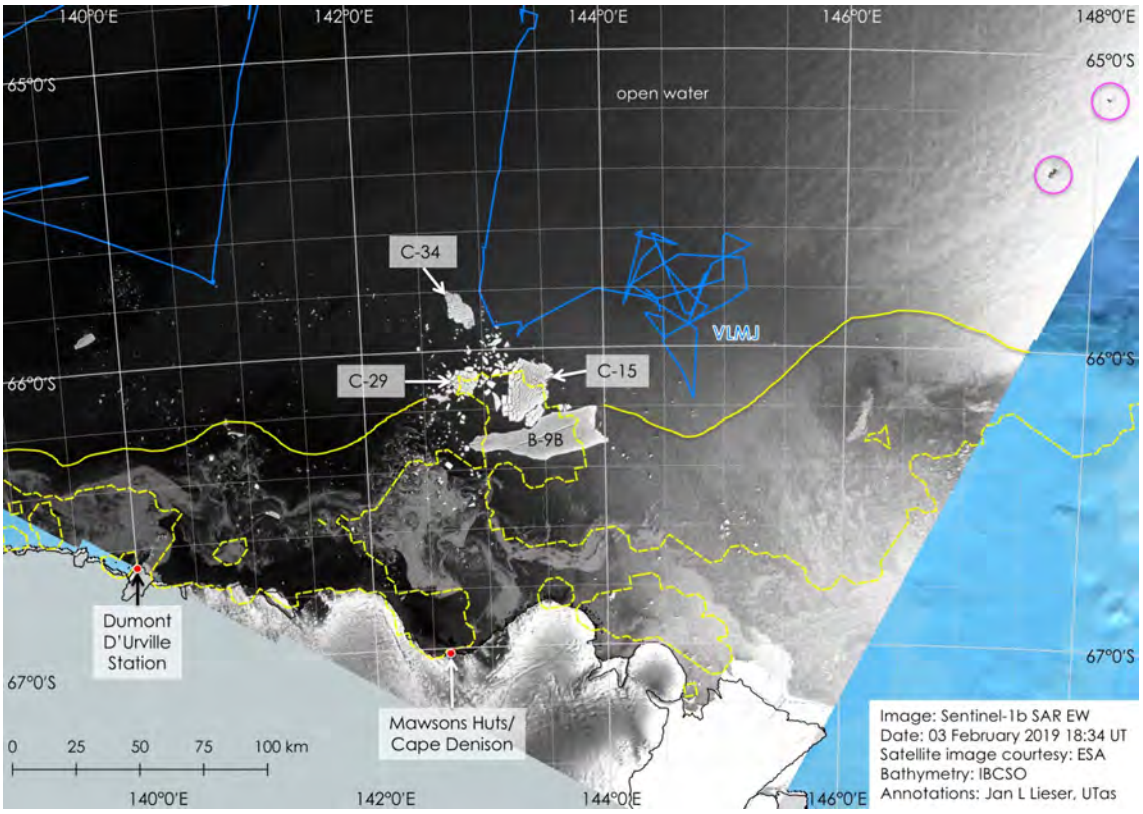

Figure 1: *Sentinel-1b SAR EW scene acquired on 03/02/2019 at 18:34 UT and provided by PolarView.*

Strips and patches of decaying sea ice can be seen south of a yellow scribble line in the figure. The dashed, yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 03/02/2019.

North of 66° S, many small icebergs can be seen, two of which are marked by pink circles in the east.

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Sea Ice Report #06.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
05/02/2019

Ross Sea

Figure 1 shows SAR and sea-ice concentration data composite of the Ross Sea. The position of RV *Tangaroa* (callsign: ZMFR) on 05/02/2019 00:00 UT is given by a light-blue dot.

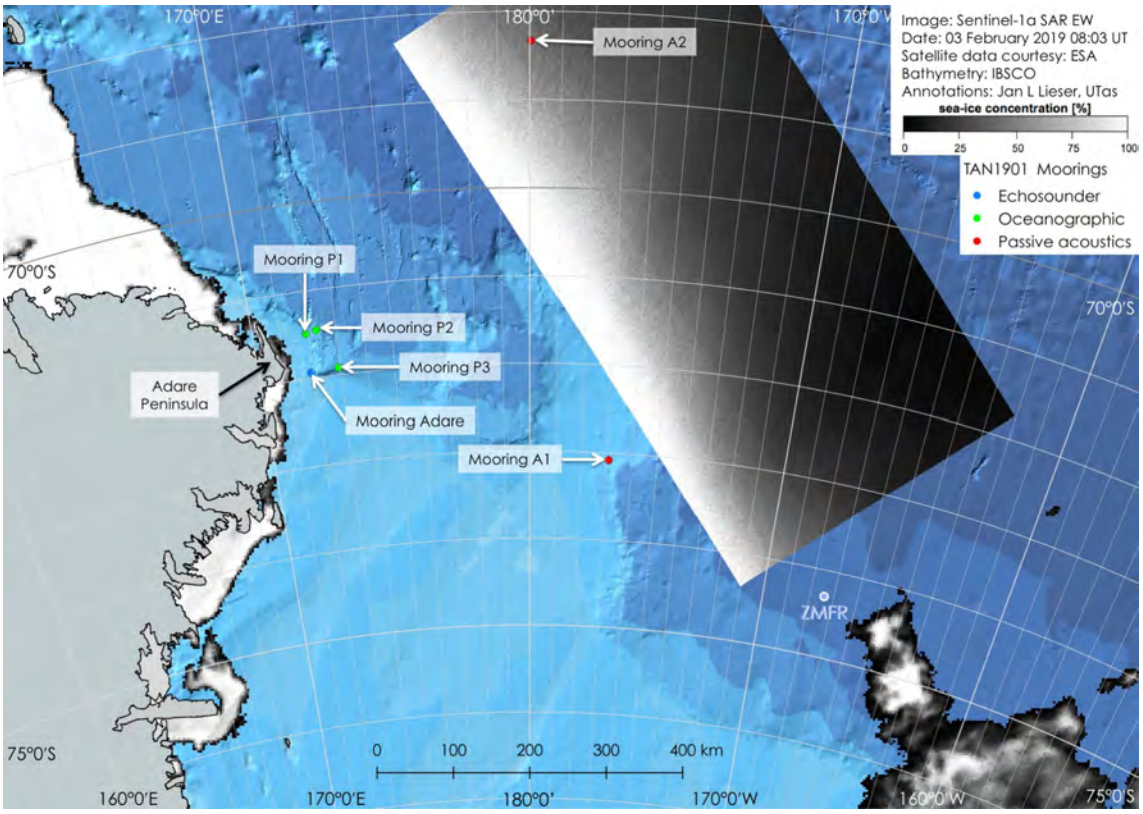

Figure 1: *Sea-ice concentration chart acquired 04/02/2019 and provided by ICDC, Universität Hamburg; overlay of Sentinel-1a SAR EW swath acquired 03/02/2019 at 08:03 UT and provided by PolarView.*

The area covered by the SAR swath is free of sea ice, but large and small icebergs, bergy bits and glacial debris may be present in the entire region of Figure 1.

Sea ice remains only west and south of Adare Peninsula, and in the southeast of the figure.

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Sea Ice Report #06.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
05/02/2019

Davis Station

Figure 1 shows a SAR scene off the Vestfold Hills and the region south of it.

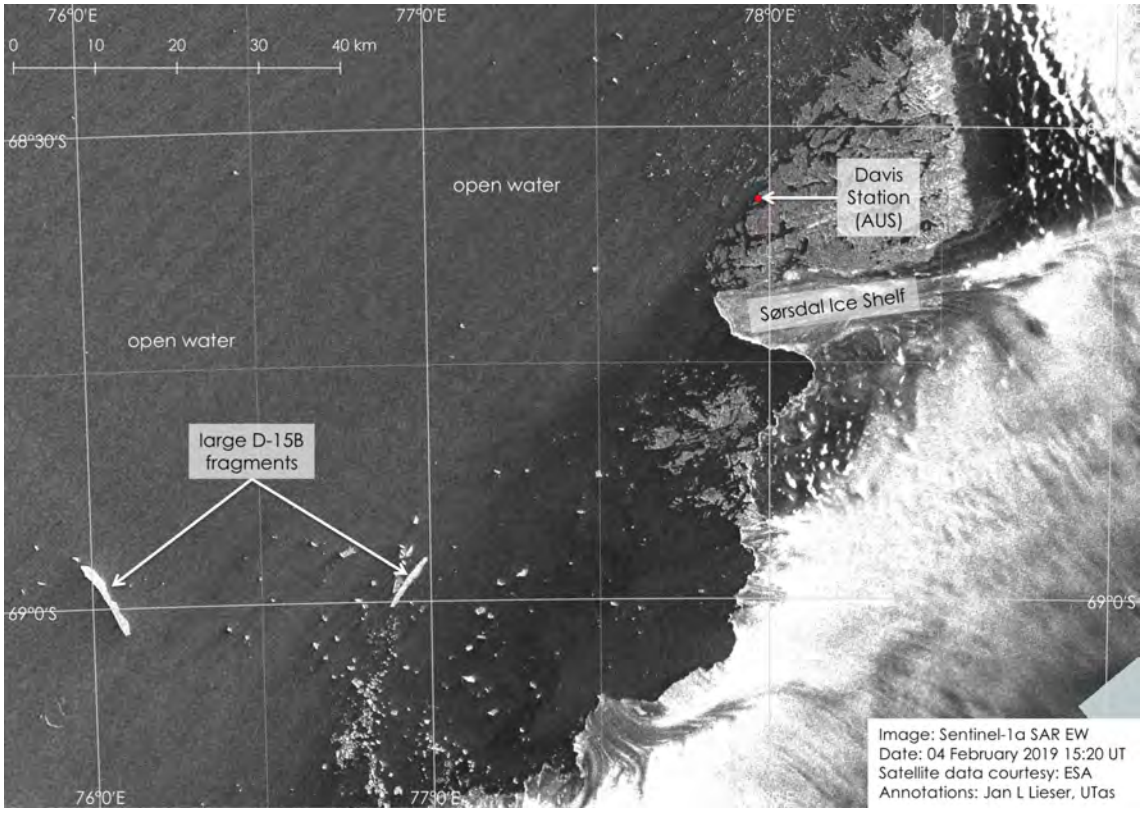

Figure 1: *Sentinel-1a SAR EW data acquired 04/02/2019 at 15:20 UT and provided by PolarView.*

Off the Vestfold Hills, a mixture of small and large icebergs and only minimal amounts of ex-fast ice debris can be seen.

Off the Sørsdal Ice Shelf, some glacial debris can still remain.

The large fragments of iceberg D-15B continue their drift southwestward off the Rauer Group.

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Sabrina Coast

Figure 2 shows a visible scene off the Moscow University Ice Shelf. A pink outline marks iceberg B-39 drifting in the so-called 'Dalton polynya'.

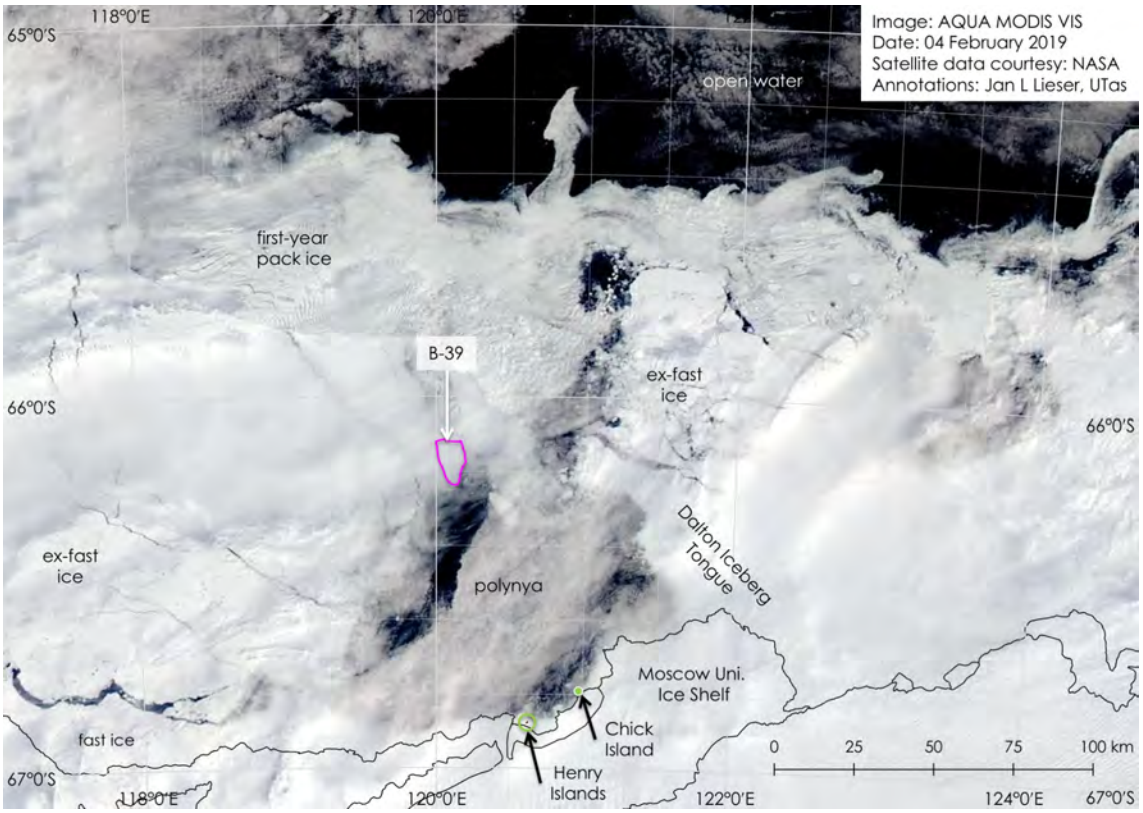

Figure 2: *AQUA MODIS VIS data acquired 04/02/2019 and provided by NASA.*

The northern part of the Dalton Iceberg Tongue shows shattered fast ice in between the bergs of the tongue. Some fast ice remains fastened between icebergs, only immediately off the Moscow University Ice Shelf.

At the northern edge of the sea ice, a curiously shaped, temporary protrusion of sea ice into the open water can be seen along 120° 50' E.

Chick Island is free of any form of sea ice offshore and Henry Islands are surrounded by shrinking fast ice.

D'Urville Sea

Figure 3 shows a SAR scene of southern D'Urville Sea between Dumont D'Urville Station and the Mertz Ice Shelf.

Along the coast, no fast ice remains shore-fast. Sea ice drifting nearshore consists predominantly of decaying ex-fast ice.

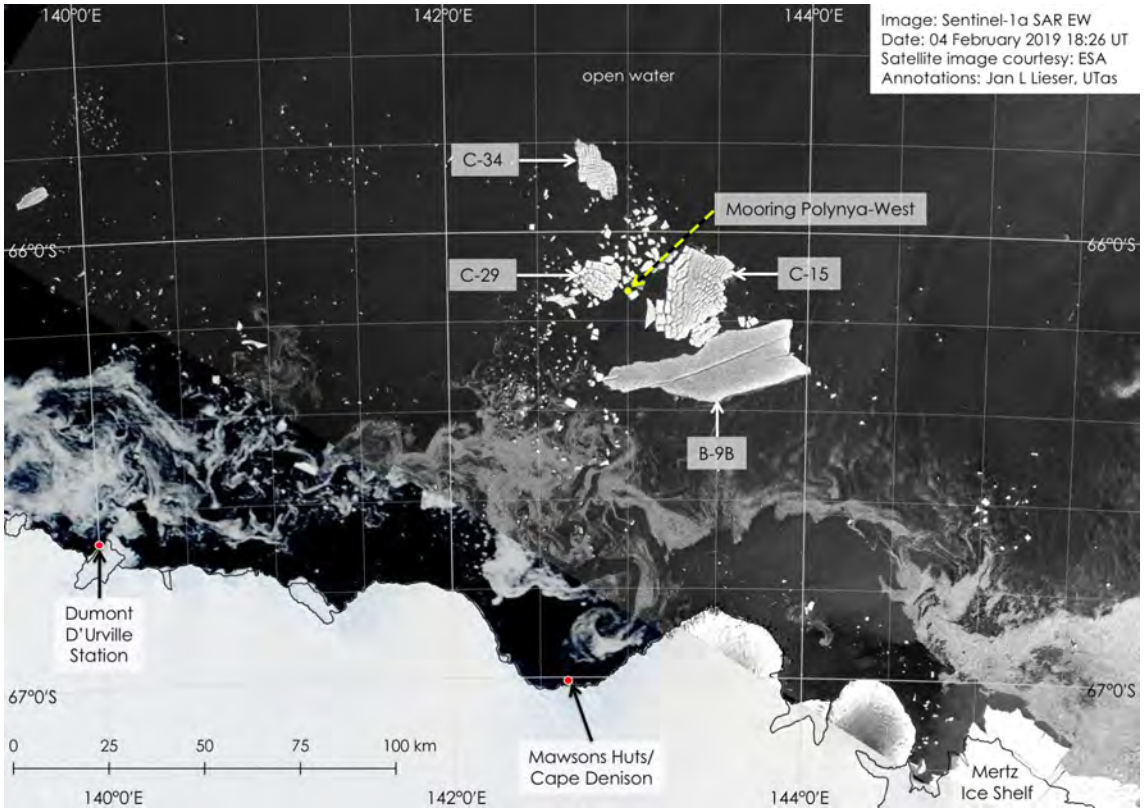

Figure 3: *Sentinel-1a SAR EW data acquired 04/02/2019 at 18:26 UT and provided by PolarView; complemented by TERRA MODIS VIS data acquired on 05/02/2019 and provided by NASA.*

Sea Ice Report #06.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
06/02/2019

Ross Sea

Figure 1 shows SAR scene of the Ross Sea. The cruise track of RV *Tangaroa* (callsign: ZMFR) on 06/02/2019 00:00 UT is given by a light-blue line.

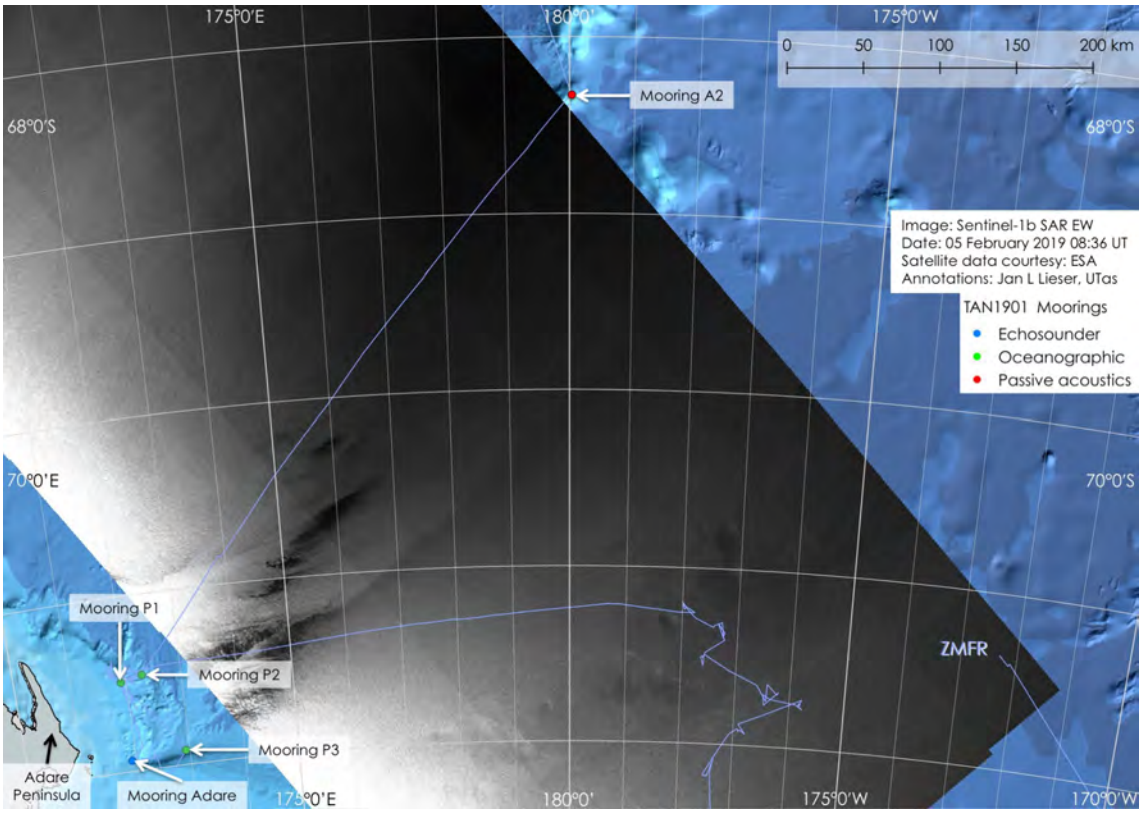

Figure 1: *Sentinel-1b SAR EW swath acquired 05/02/2019 at 08:36 UT and provided by PolarView.*

The area covered by the SAR swath is free of sea ice, but icebergs of less than less 50 m waterline length (defined as the longest horizontal dimension the the water plane), bergy bits and glacial debris may be present in the entire region of Figure 1.

*Disclaimer: *Every effort is made to ensure the data provided in this report are accurate at the date of publication; however the report is provided without warranty of any kind. The figures and charts provided in this report are intended only as a guide to ice conditions and are not suitable for navigation.*

Sea Ice Report #06.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
07/02/2019

Mawson Station

Figure 1 shows a visible scene off Mawson Coast. The cruise track of RSV *Aurora Australis* (up until 07/02/2019 02:00 UT) is marked by an orange line.

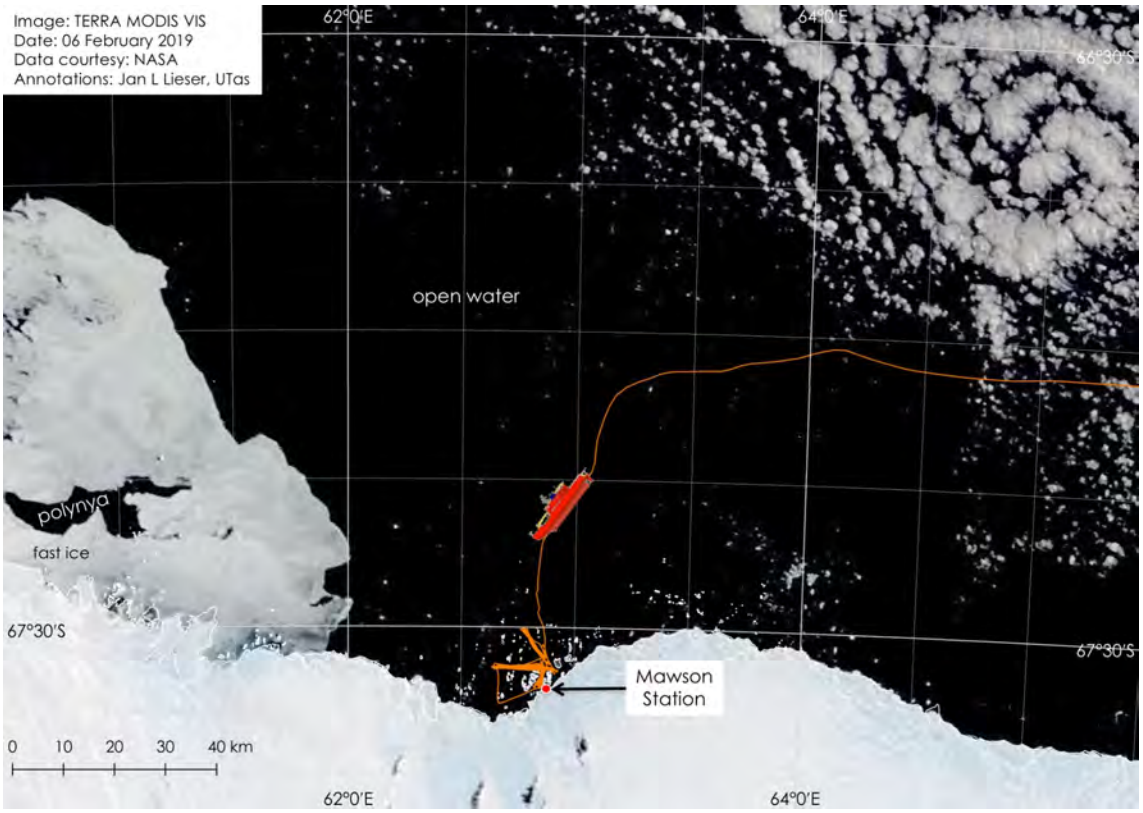

Figure 1: *TERRA MODIS VIS data acquired 06/02/2019 and provided by NASA.*

North and east of the the station, most of the fast ice has dislodged and disappeared, but many icebergs remain local.

Figures 2 and 3 show SAR and high-resolution visible imagery, respectively, of Mawson Station's vicinity. The position of RSV *Aurora Australis* (call sign VNAA) at the times of image acquisition are showing up clearly. During the time between the two satellite overflights (13 hours), the fast ice of Kista Straight (off station outside Horseshoe Harbour) has largely broken up.

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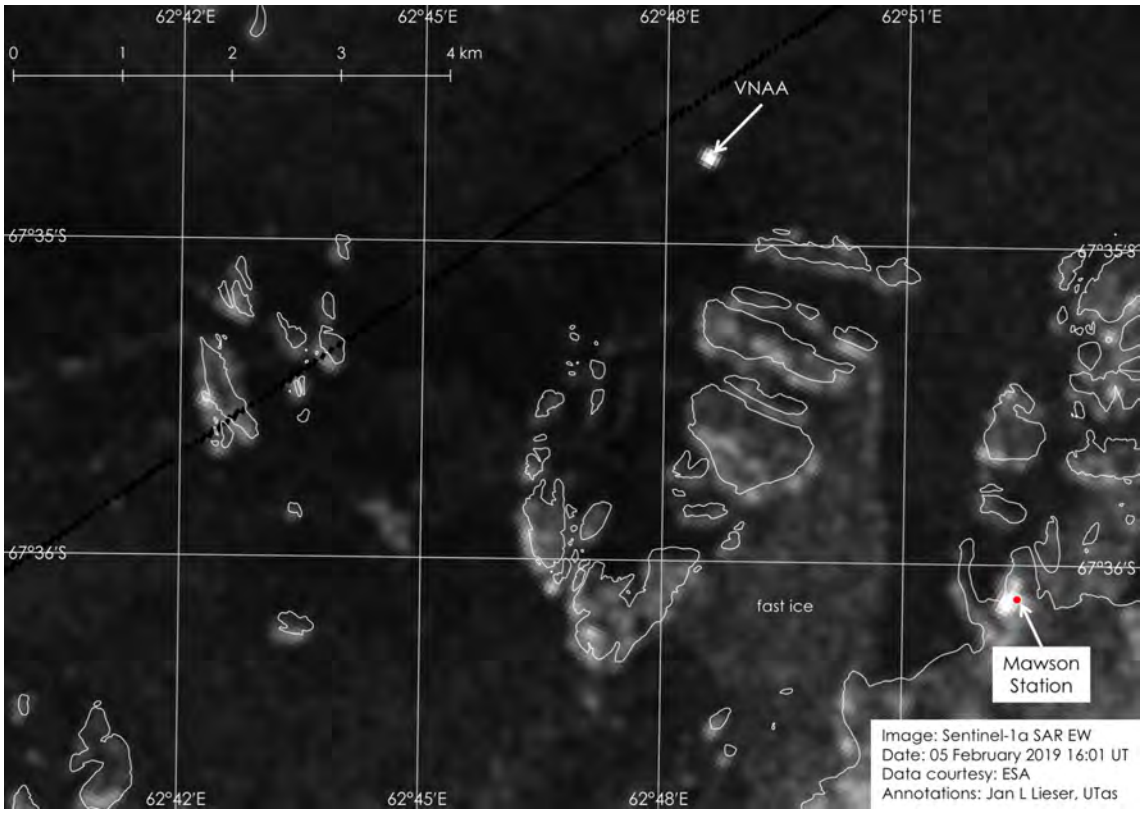

Figure 2: *Sentinel-1a SAR EW data acquired 05/02/2019 at 16:01 UT and provided by PolarView.*

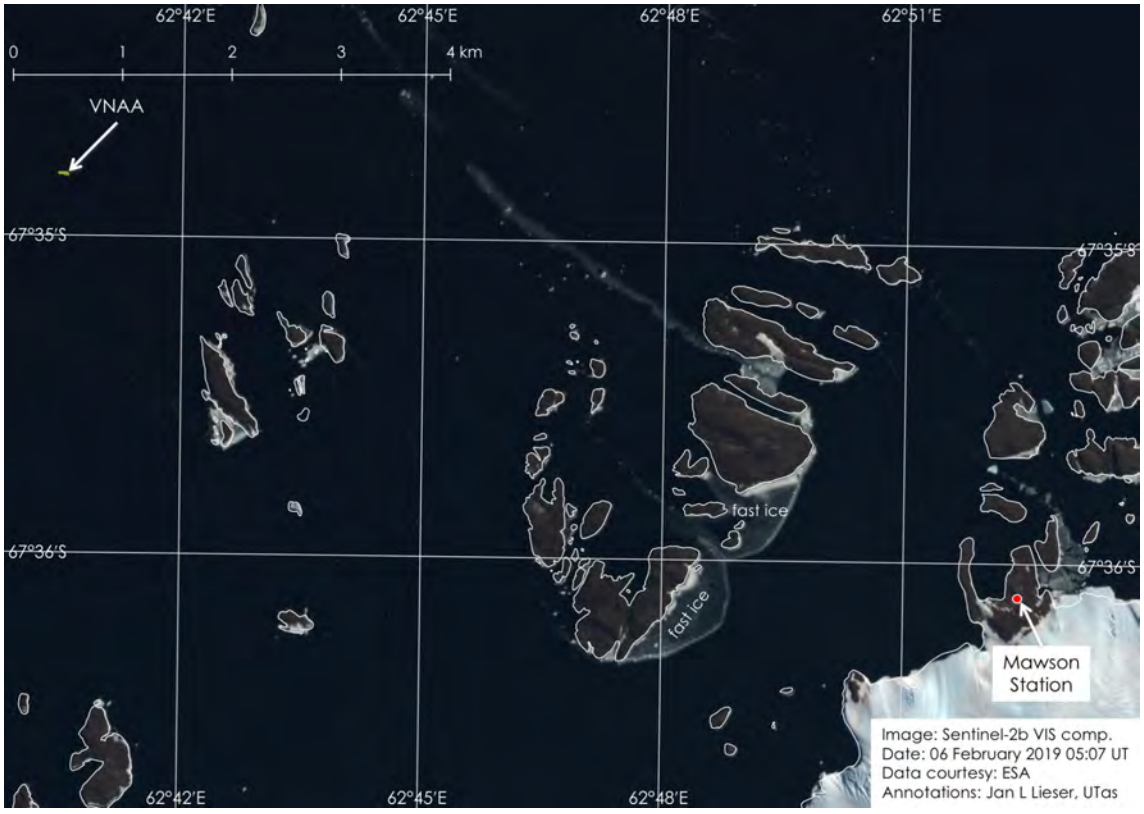

Figure 3: *Sentinel-2b visible composite data acquired 06/02/2019 at 05:20 UT and provided by USGS.*

Davis Station

Figure 4 shows a high-resolution SAR scene off the Vestfold Hills and the Rauer Group south of it. The recent cruise track of RSV *Aurora Australis* in the region is marked by an orange line.

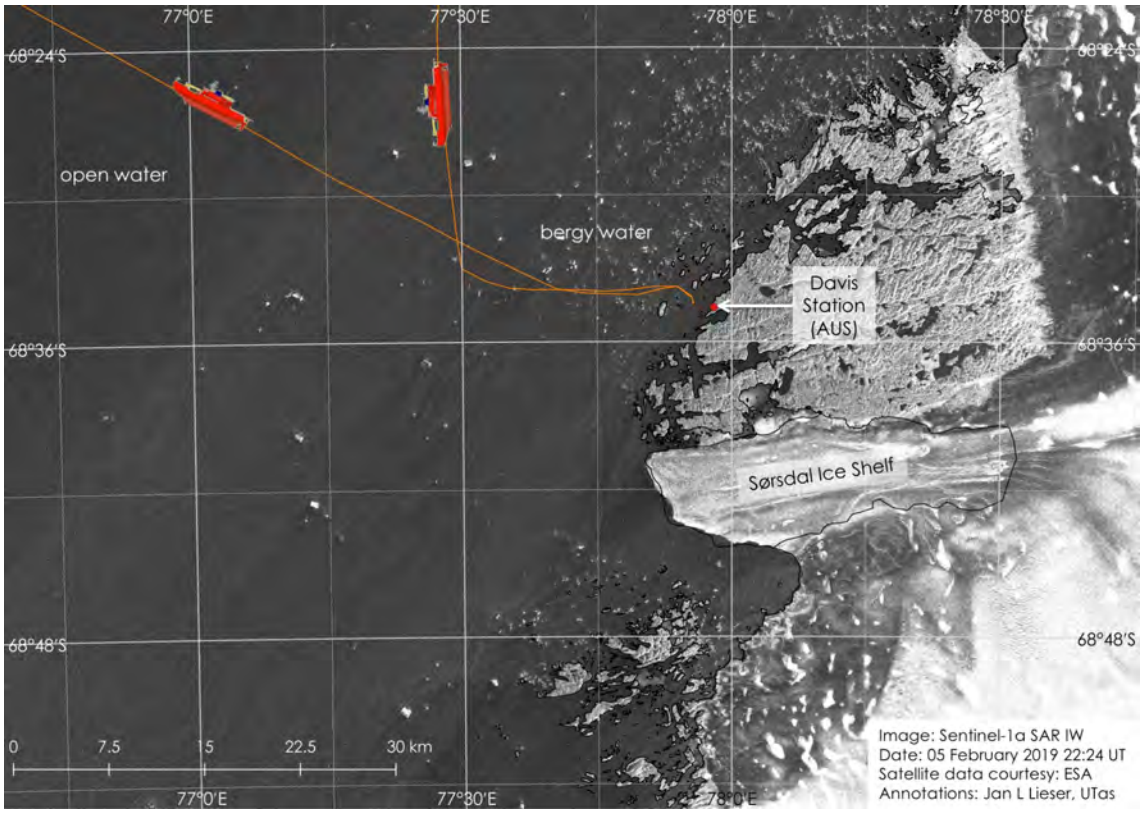

Figure 4: *Sentinel-1a SAR IW data acquired 05/02/2019 at 22:24 UT and provided by PolarView.*

Off the Vestfold Hills, a mixture of small and large icebergs, and only minimal amounts of ex-fast ice debris can be seen.

Off the Sørsdal Ice Shelf, some glacial debris may still remain.

Casey Station

Figure 5 shows a high-resolution SAR scene off Casey Station and surrounds.

Offshore, loose patches of melting sea ice are floating while only minimal pockets of fast ice can be seen (marked by red boundaries). The offshore sea ice consists mainly of late-stage decay first-year sea ice and breaking up fast ice, which originates from Petersen Bank (north of Casey Station, outside the frame of Figure 5) where only reduced fast ice remains shore-fast.

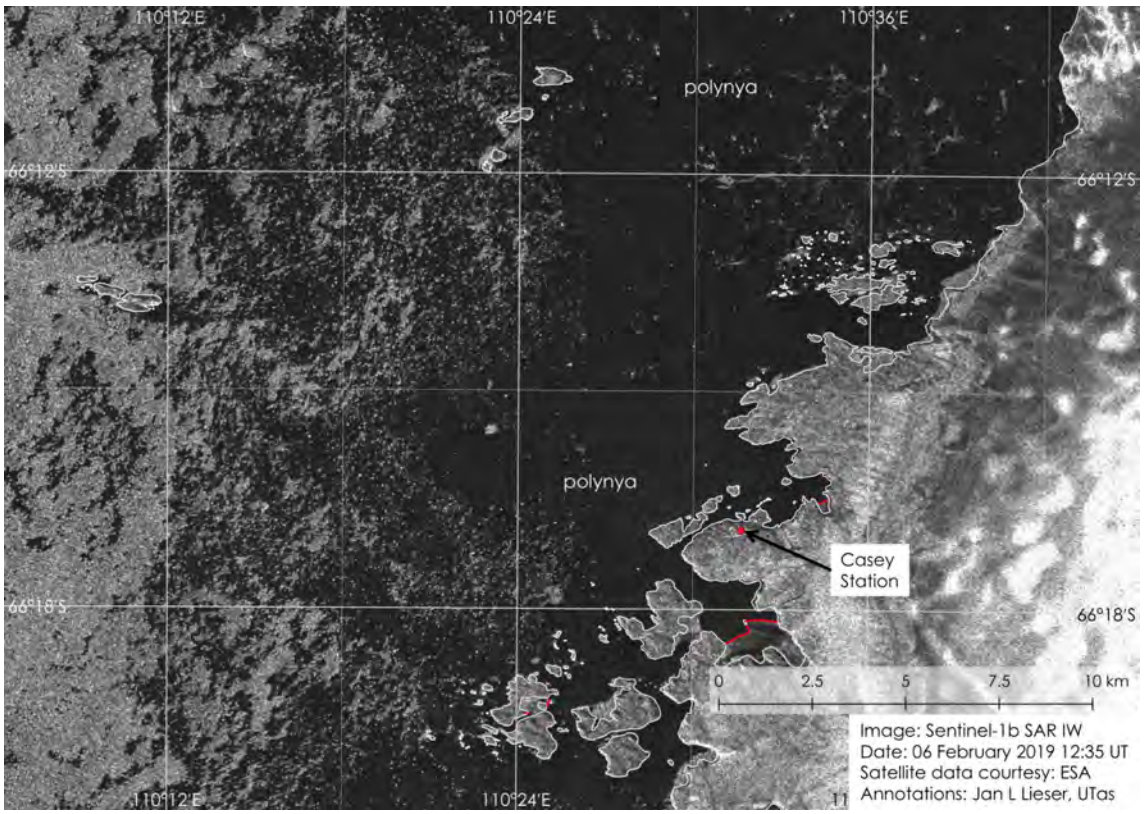

Figure 5: *Sentinel-1b SAR IW data acquired 06/02/2019 at 12:35 UT and provided by PolarView.*

Sea Ice Report #06.7/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
07/02/2019

D'Urville Sea

Figure 1 shows a visible scene of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a blue line (up until 07/02/2019 02:00 UT). The yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 06/02/2019.

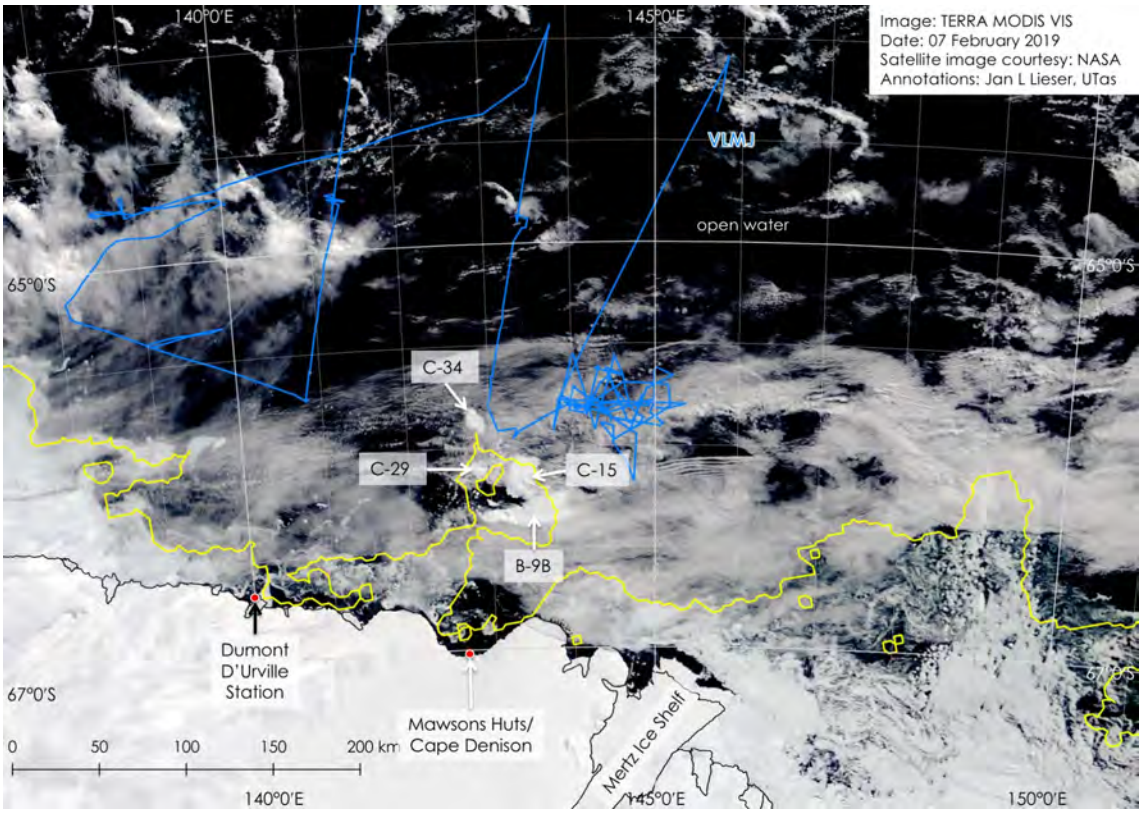

Figure 1: *TERRA MODIS VIS scene acquired on 07/02/2019 and provided by NASA.*

Strips and patches of decaying sea ice can be seen along a yellow line in the figure.

Icebergs, bergy bits and glacial debris may be present in the entire region of Figure 1.

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Sea Ice Report #07.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/02/2019

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for January 2019.

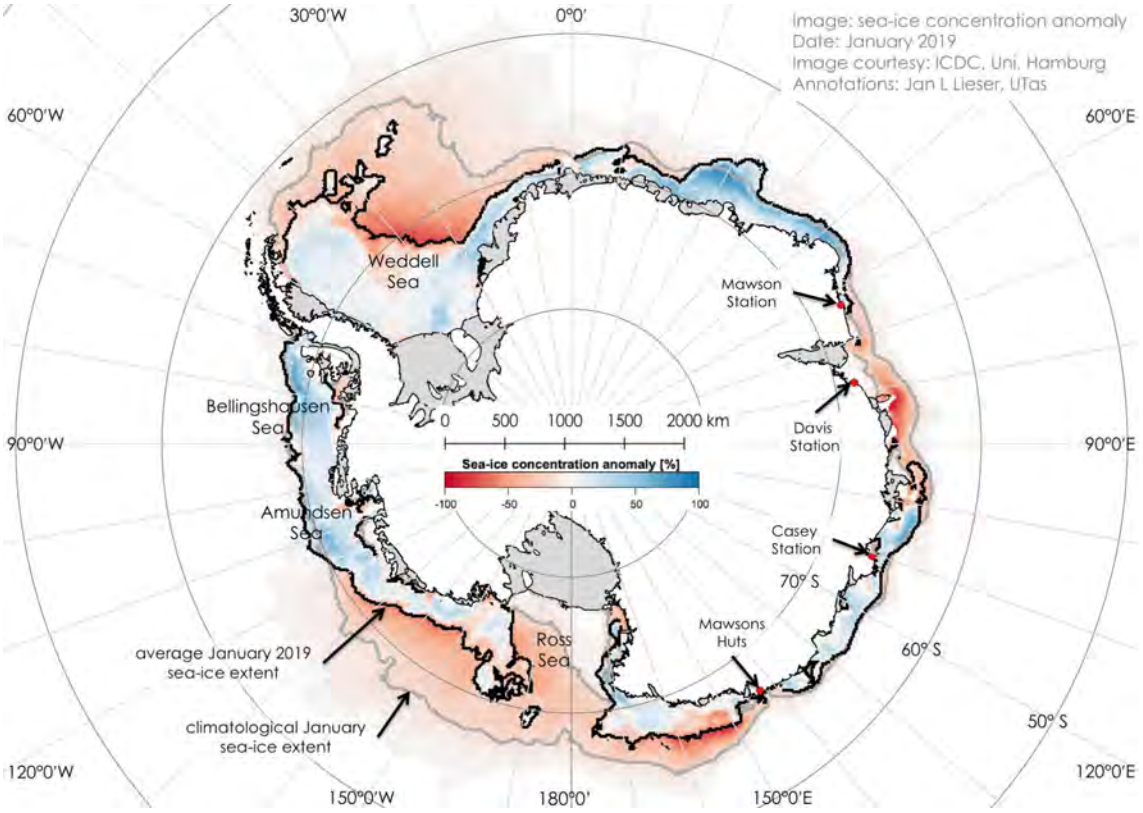

Figure 1: *Sea-ice concentration anomaly for January 2019 provided by ICDC, Universität Hamburg.*

During January 2019, sea-ice extent remained below average (relative to 1992-2018) conditions throughout most of Antarctica, as can be seen by the almost continuous red sea-ice margin in the chart (Figure 1).

In East Antarctica, low sea-ice extent is accompanied by below average sea-ice concentration west of 90° E toward roughly the longitude of Mawson Station, but above average concentration within average extent between 105° E and 145° E.

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Sea Ice Report #07.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/02/2019

D'Urville Sea

Figure 1 shows a visible scene of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a blue line (up until 12/02/2019 01:00 UT). The yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 11/02/2019.

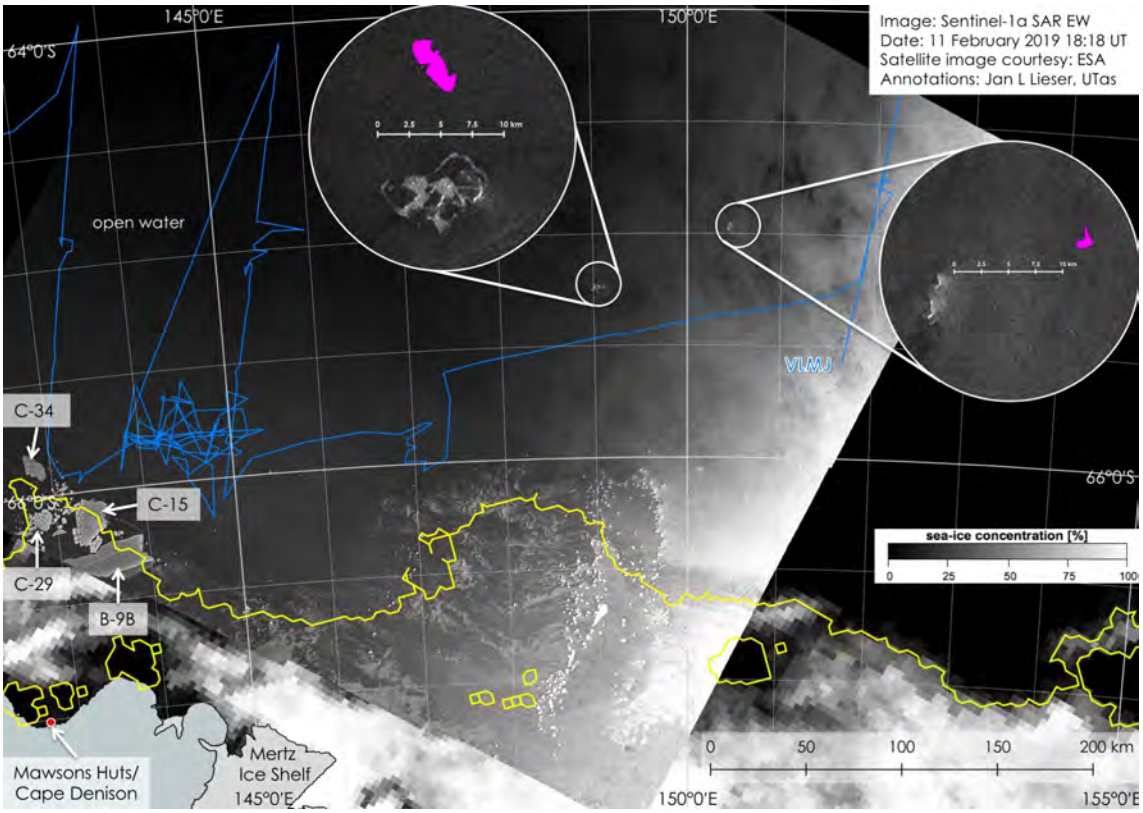

Figure 1: *Sentinel-1a SAR EW scene acquired on 11/02/2019 at 18:18 UT and provided by PolarView; complemented by sea-ice concentration data acquired 11/02/2019 and provided by ICDC, Universität Hamburg.*

Two magnified regions show areas of shattering icebergs, which were identified in SAR imagery on 10/02/2019 at 18:20 UT (indicated by pink shapes) and drifting southward (at 149° 0' E) and westward (at 150° 30' E).

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Sea Ice Report #07.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/02/2019

Davis Station

Figure 1 shows a SAR scene off the Vestfold Hills and vicinity. The recent cruise track of RSV *Aurora Australis* during the past weekend is marked by an orange line.

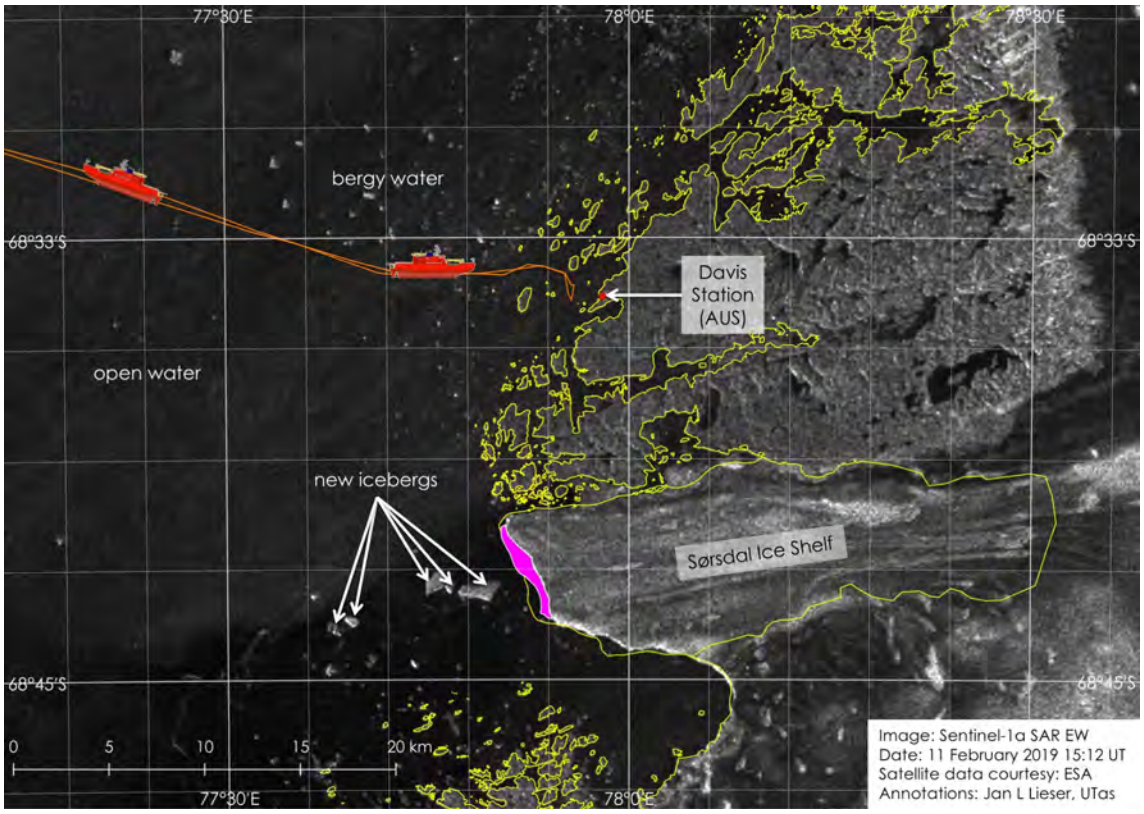

Figure 1: *Sentinel-1a SAR EW data acquired 11/02/2019 at 15:12 UT and provided by PolarView.*

Between 05/02/2019 and 09/02/2019, the front of the Sørsdal Ice Shelf has calved roughly 2.8 km^2 (marked by a pink shape in the figure). A number of new icebergs can be seen west of the front of the shelf.

There is no significant sea ice in the area.

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Figure 2 provides a larger-scale overview of the region southwest of Davis Station.

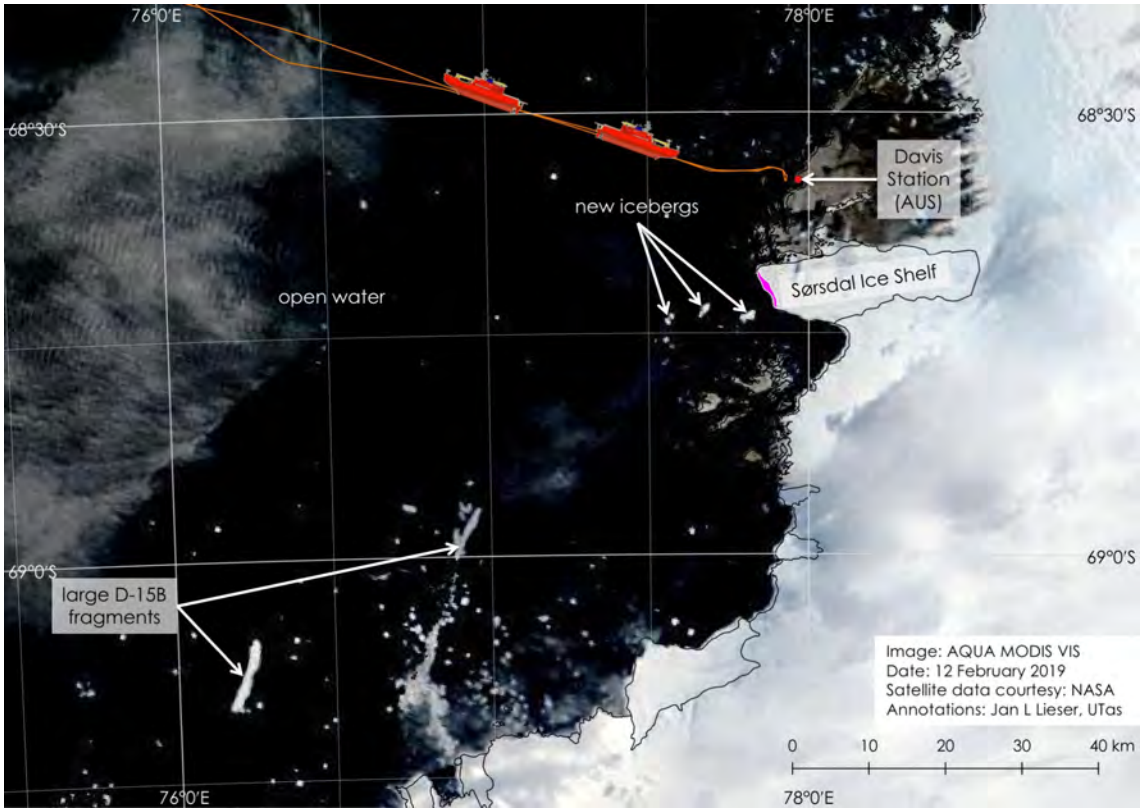

Figure 2: *TERRA MODIS VIS acquired 12/02/2019 and provided by NASA.*

Sea Ice Report #07.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
13/02/2019

Davis Station

Figure 1 shows a high-resolution visible scene off the Vestfold Hills and vicinity.

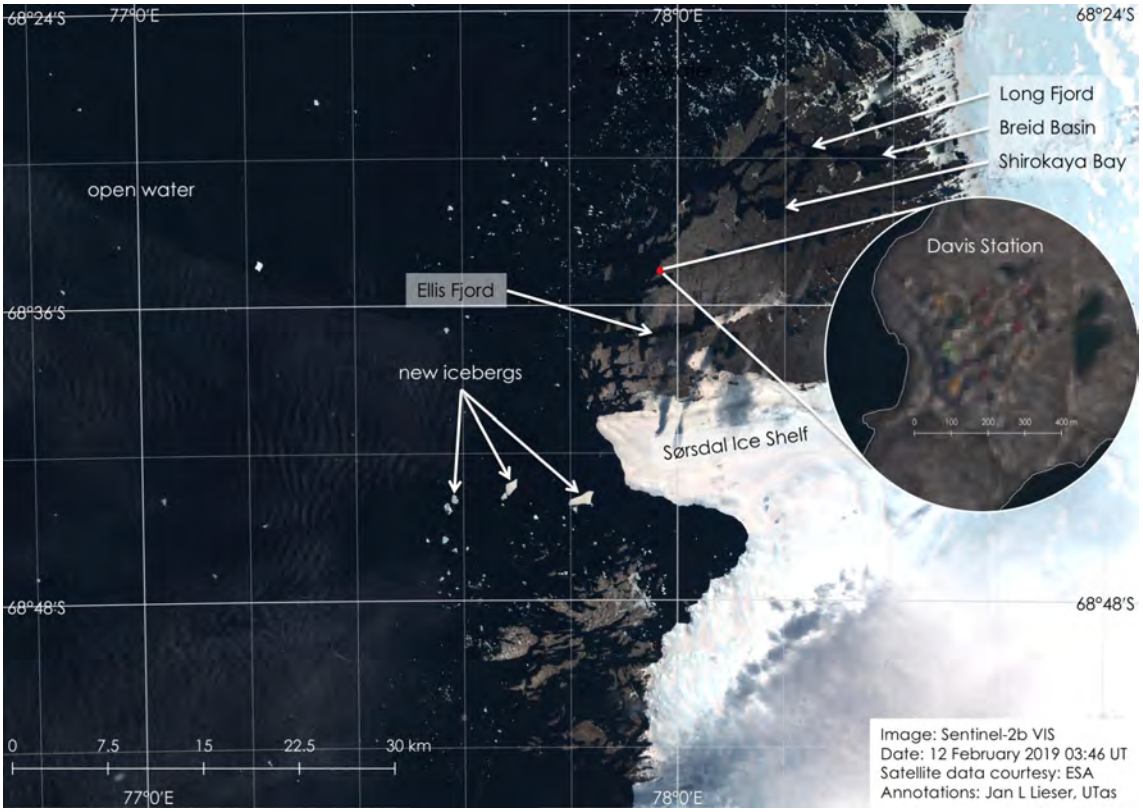

Figure 1: *Sentinel-2b visible data acquired 12/02/2019 at 03:46 UT and provided by USGS.*

Off Davis Station, many grounded and free floating icebergs are offshore. The icebergs, which have calved off the front of the Sørsdal Ice Shelf recently, can be seen west of the front of in the shelf.

The high-resolution data also show that many of the fjords and lakes north and south of the station have open water. Only between islands of the northern tip of the hills and the eastern part of Ellis Fjord, some fast ice remains landlocked.

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Bunger Hills

Figure 2 shows a high-resolution visible scene of the Bunger Hills (roughly 450 km west of Casey Station).

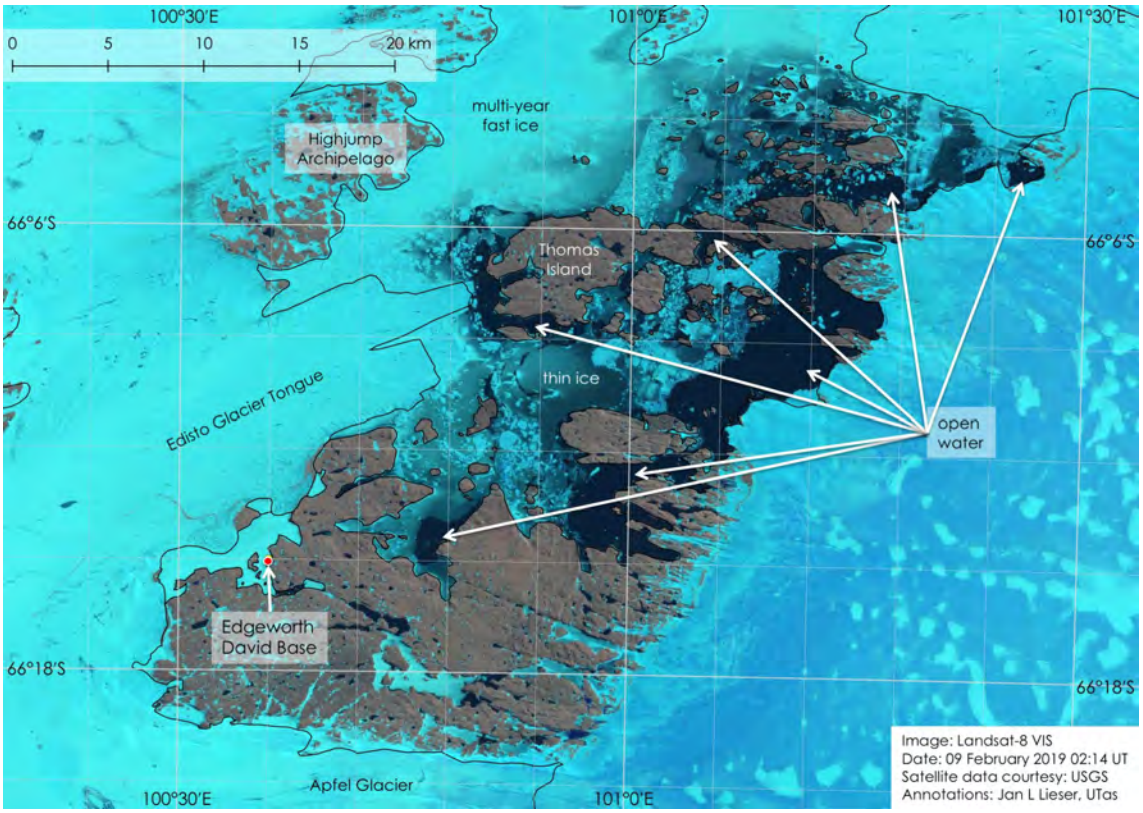

Figure 2: *Landsat-8 VIS acquired 09/02/2019 at 02:14 UT and provided by USGS.*

The horizontal resolution and colourisation of the data allows for visualisation of the amount of open water patches in between the hills, which is still expanding (see Sea Ice Report #05.3/2019 for comparison).

Sea Ice Report #07.5/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
14/02/2019

D'Urville Sea

Figure 1 shows a SAR and visible composite of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a blue line (up until 14/02/2019 00:00 UT). The yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 13/02/2019.

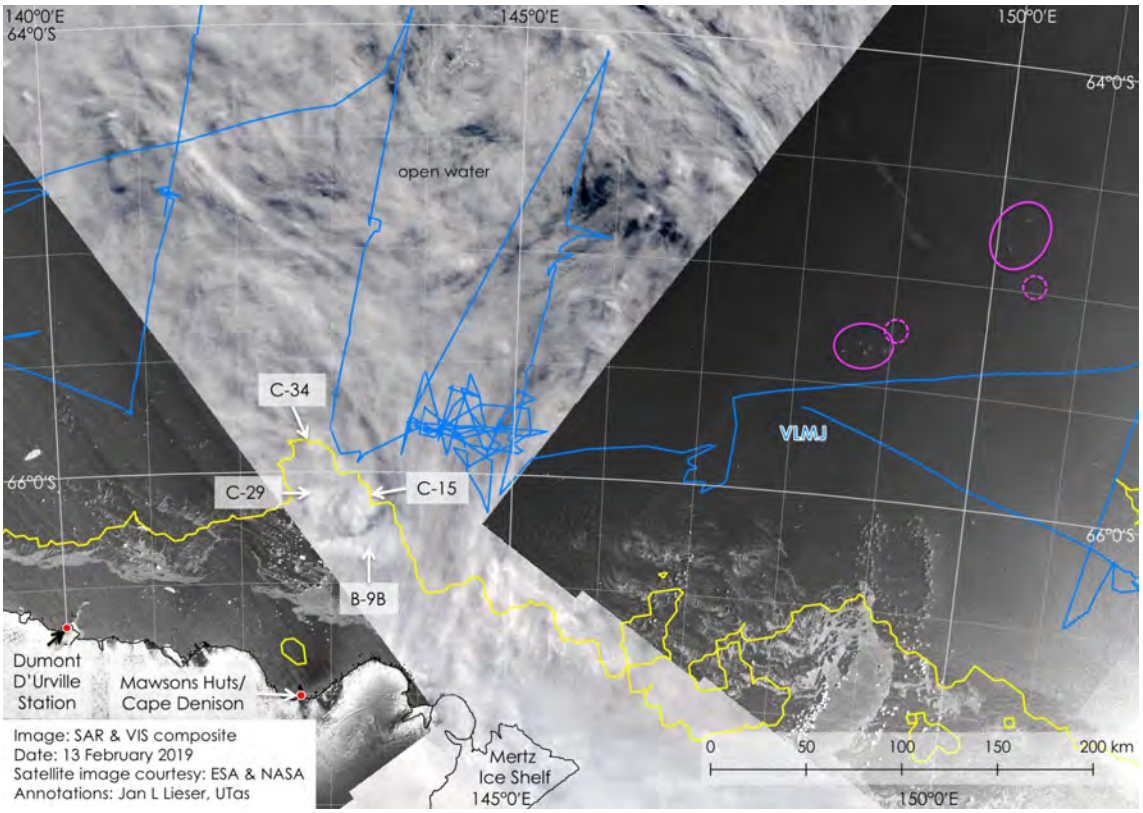

Figure 1: *Sentinel-1b SAR EW scene (western tile) acquired on 13/02/2019 at 10:48 UT and Sentinel-1a SAR EW scene (eastern tile) acquired on 13/02/2019 at 18:02 UT, both provided by PolarView; complemented by TERRA MODIS VIS data acquired 13/02/2019 and provided by NASA.*

The actual ice limit is further north than what the passive microwave data suggests as the sea-ice edge.

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Two shattered icebergs (circled in pink), which were identified in previous SAR imagery (dashed circles; see Sea Ice Report #07.2/2019), are spreading further.

Figure 2 shows a sea-ice concentration chart of D'Urville Sea and further east towards the Balleny Islands. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a white line (up until 14/02/2019 00:00 UT). The February median sea-ice extent (relative to 1981-2010) is marked as a green line.

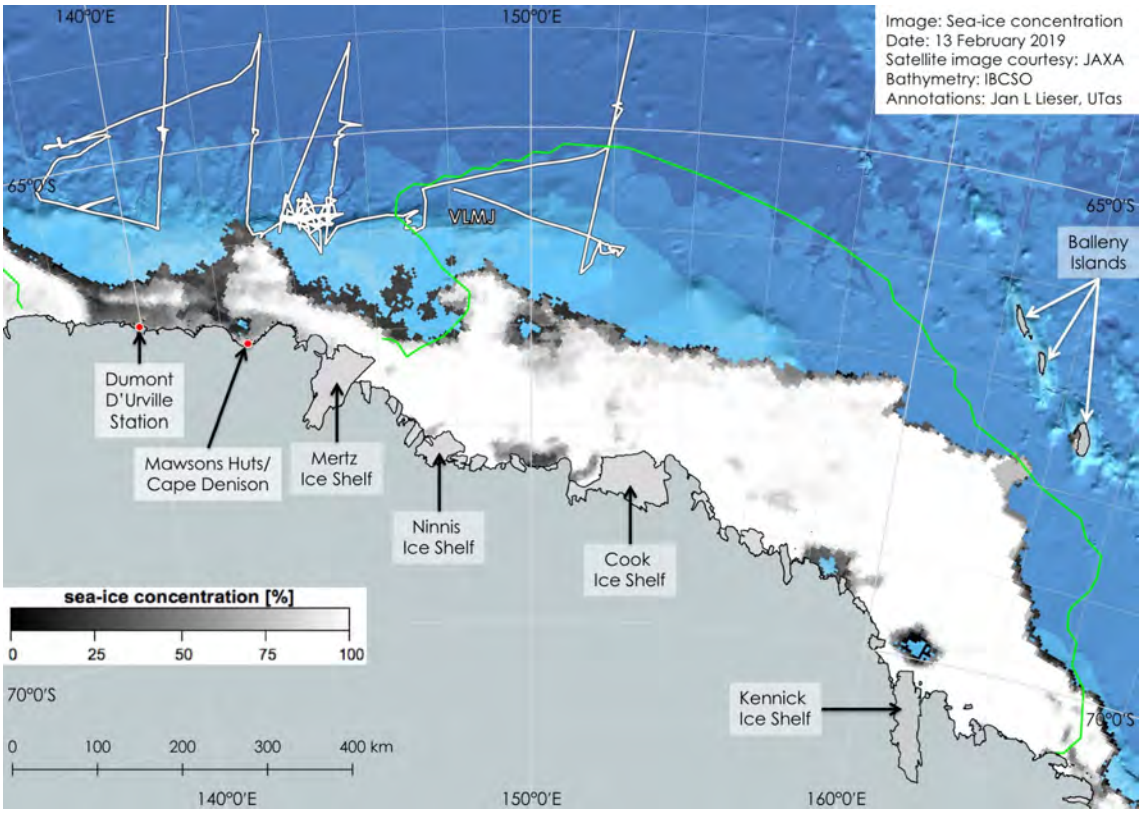

Figure 2: *Sea-ice concentration chart data acquired 13/02/2019 and provided by Universität Hamburg.*.

Although there remains some sea ice between Dumont D'Urville Station and the Mertz Ice Shelf (note that the sea-ice concentration is overestimated north of Cape Denison due to the presence of four large, tabular icebergs), further east the sea-ice extent is below (south of) the median for this time of year.

Sea Ice Report #07.6/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
15/02/2019

Davis Station

Figure 1 shows a SAR composite of the Vestfold Hills and south of it. The recent cruise tracks of RSV *Aurora Australis* are marked as orange lines. The vessel is currently at Davis Station.

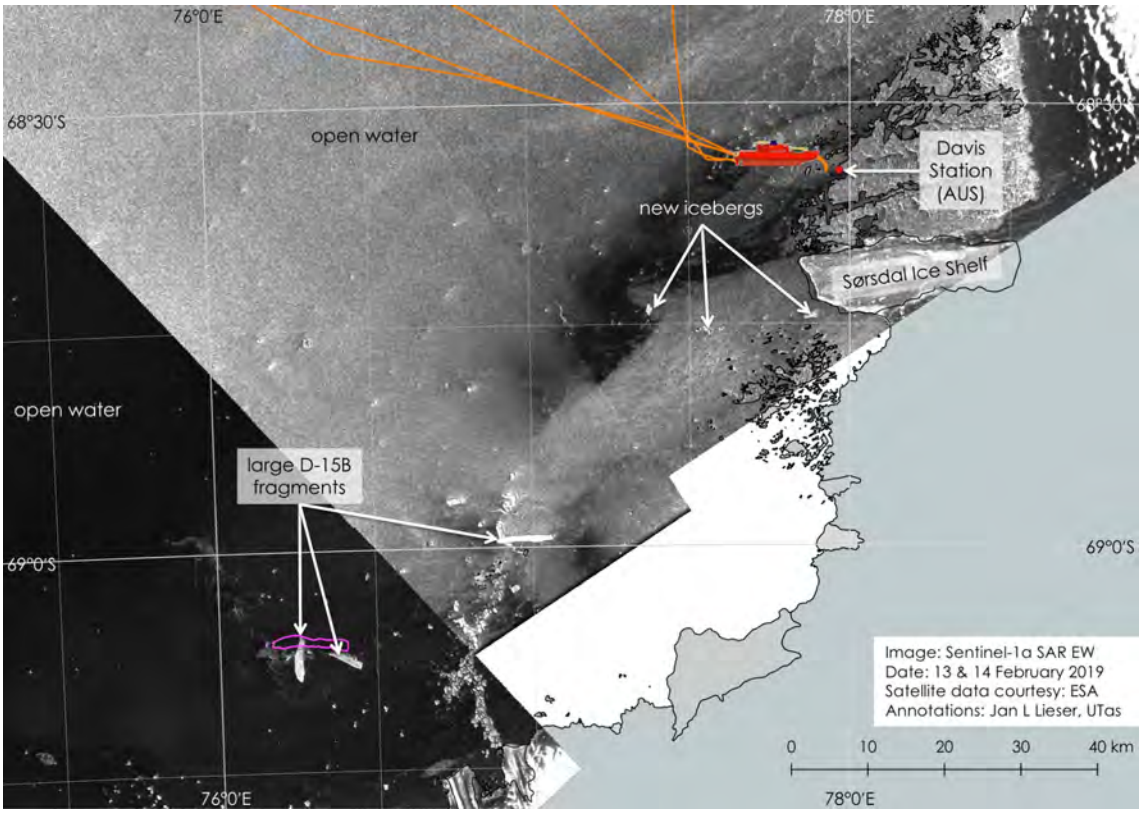

Figure 1: *Sentinel-1a SAR EW data; northern tile acquired 13/02/2019 at 14:56 UT and southern tile acquired 14/02/2019 at 15:36 UT, both provided by PolarView.*

Between the two tile acquisitions, the larger (southern) of the two D-15B fragments snapped in the middle into two icebergs (the position of the original fragment on 13/02/2019 at 14:56 UT is marked by the pink shape).

Off the Sørsdal Ice Shelf, the newly formed icebergs are drifting apart, but the largest of the new bergs remains just north of the Rauer Group.

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Sabrina Coast

Figure 2 shows a visible scene of Sabrina Coast.

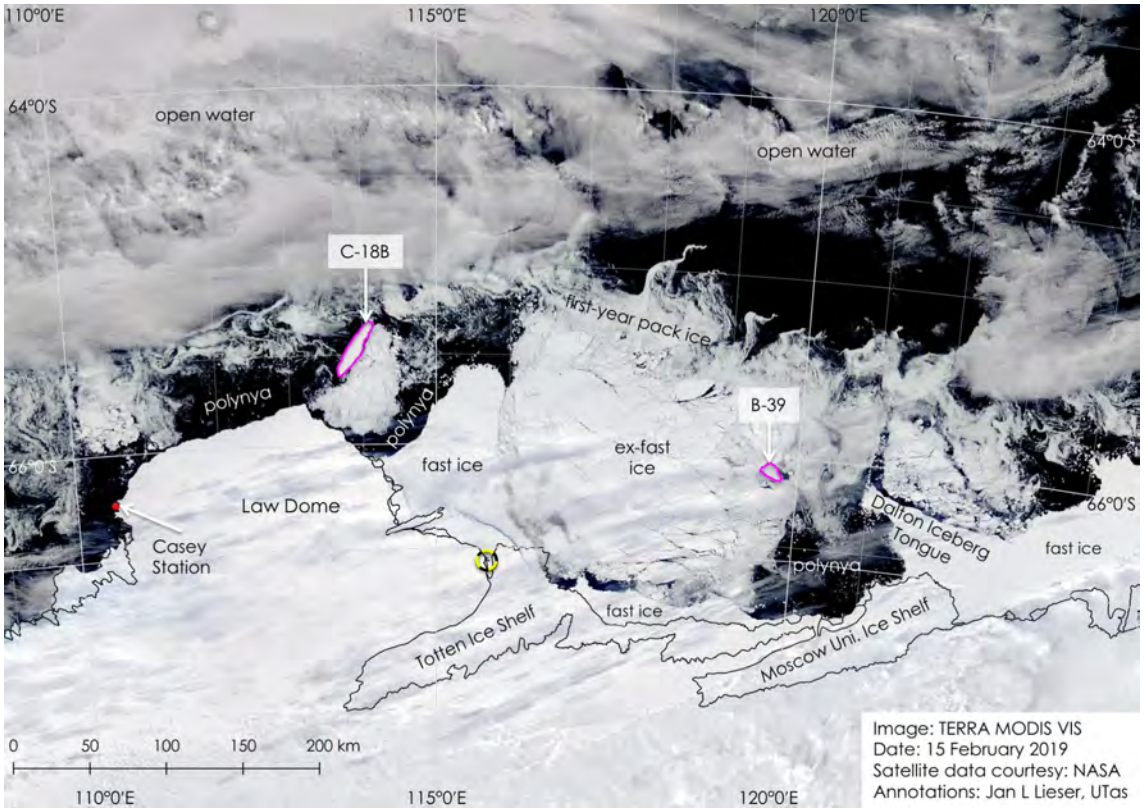

Figure 2: *TERRA MODIS VIS data acquired 15/02/2019 and provided by NASA.*

At Petersen Bank north of Casey Station, fast ice has completely broken up. East of iceberg C-18B, the broken ex-fast ice has been turned into smaller pieces, but the majority of those pieces is still trapped behind rows of small, grounded icebergs and iceberg C-18B. North of the Dalton Iceberg Tongue, fast ice has also broken into small pieces and those pieces are decaying locally.

North of the Totten Ice Shelf, a curious patch of open water (marked by a yellow/black circle) has reappeared surrounded by ice sheet (Law Dome) in the west, Totten Ice Shelf in the east and multi-year fast ice in the north.

Sea Ice Report #08.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
18/02/2019

D'Urville Sea

Figure 1 shows a SAR and sea-ice concentration data composite of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a blue line (up until 18/02/2019 01:00 UT). The yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 17/02/2019.

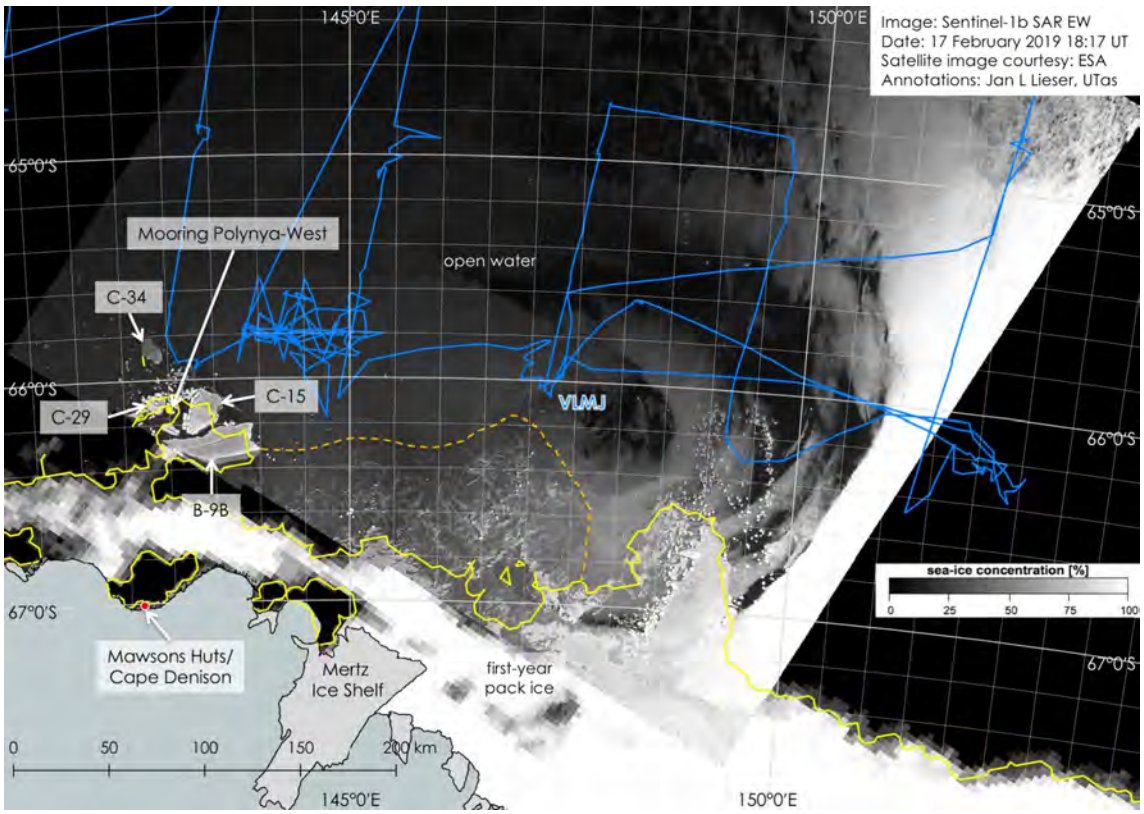

Figure 1: *Sentinel-1b SAR EW scene acquired on 17/02/2019 at 18:17 UT and provided by PolarView; complemented by sea-ice concentration data acquired 17/02/2019 and provided by ICDC, Universität Hamburg.*

The dashed, orange line marks a northern boundary of decaying sea ice north of the Mertz Ice Shelf, as the actual ice limit is further north than what the passive microwave data suggests as the sea-ice edge.

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Sea Ice Report #08.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
19/02/2019

Davis Station

Figure 1 shows a SAR and visible data composite of Davis Sea. The recent cruise track of RSV *Aurora Australis* is marked as an orange line, since the vessel departed Davis Station (up until 19/02/2019 00:00 UT).

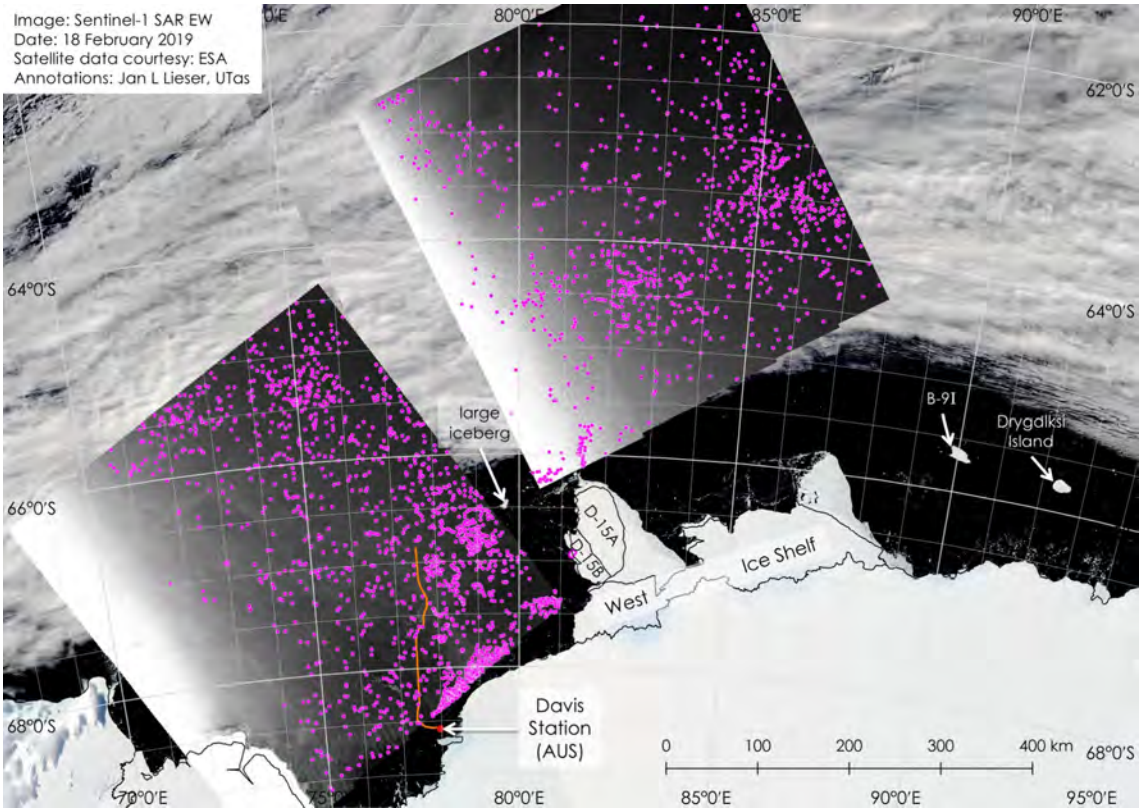

Figure 1: *Northern tile: Sentinel-1b SAR EW data acquired 18/02/2019 at 14:15 UT; Southern tile: Sentinel-1a SAR EW data acquired 18/02/2019 at 15:04 UT, both provided by PolarView; Background: AQUA MODIS VIS acquired 18/02/2019 and provided by NASA.*

As far as they are positively identifiable in the SAR data, many of the small to medium sized icebergs of the region are marked as pink dots. The vast majority of these bergs are drifting freely.

Off iceberg D-15B, a new fragment is marked by a pink shape.

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Sea Ice Report #08.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
21/02/2019

D'Urville Sea

Figure 1 shows a SAR and visible composite of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a white line (up until 21/02/2019 00:00 UT). The yellow line marks the sea-ice edge as deduced from sea-ice concentration data based on passive microwave data acquired on 20/02/2019.

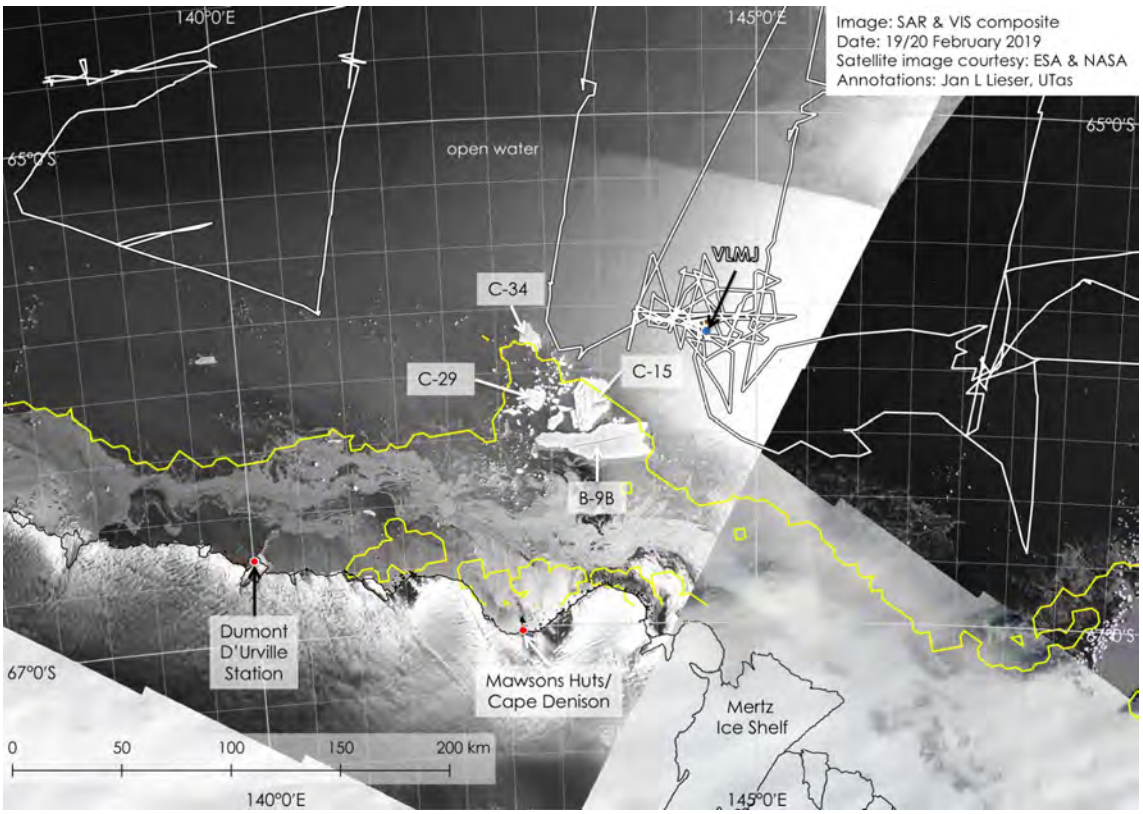

Figure 1: *Sentinel-1b SAR EW scenes acquired on 19/02/2019 at 18:01 UT (eastern tile) and acquired on 20/02/2019 at 18:42 UT (western tile), both provided by PolarView; complemented by AQUA MODIS VIS data acquired 20/02/2019 and provided by NASA.*

The actual ice limit is further north than what the passive microwave data suggests as the sea-ice edge.

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Figure 2 shows a larger overview of Figure 1 with a sea-ice concentration chart as background.

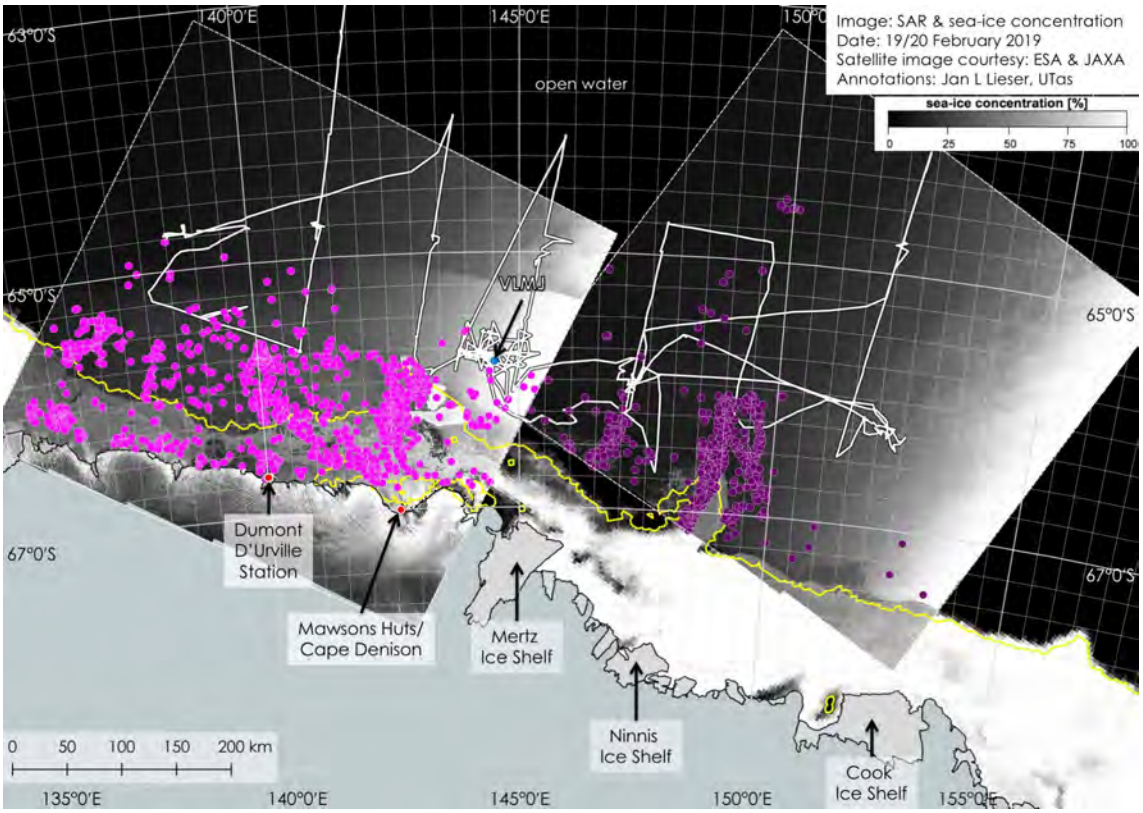

Figure 2: *Same two SAR scenes as of Figure 1 but with a background of sea-ice concentration data acquired 20/02/2019 and provided by Universität Hamburg.*

Both SAR scenes (outlined by dashed, white frames) have been analysed for the presence of icebergs. In the western scene, 548 icebergs have been identified and marked by bright pink dots (including the 'Big Four' large tabular icebergs) and in the eastern scene, 493 have been identified and marked by dark pink dots.

Note: iceberg detection is currently experimental and the lack of positive identification of icebergs east of 150° E is likely due to unfavourable SAR geometry and weather conditions at the time of data acquisition.

Icebergs and glacial debris may be encountered within the entire geographical frame of Figure 2 (and therefore Figure 1 as well).

Sea Ice Report #08.4/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
21/02/2019

Bunger Hills

Figure 1 shows a high-resolution visible scene of the Bunger Hills (roughly 450 km west of Casey Station).

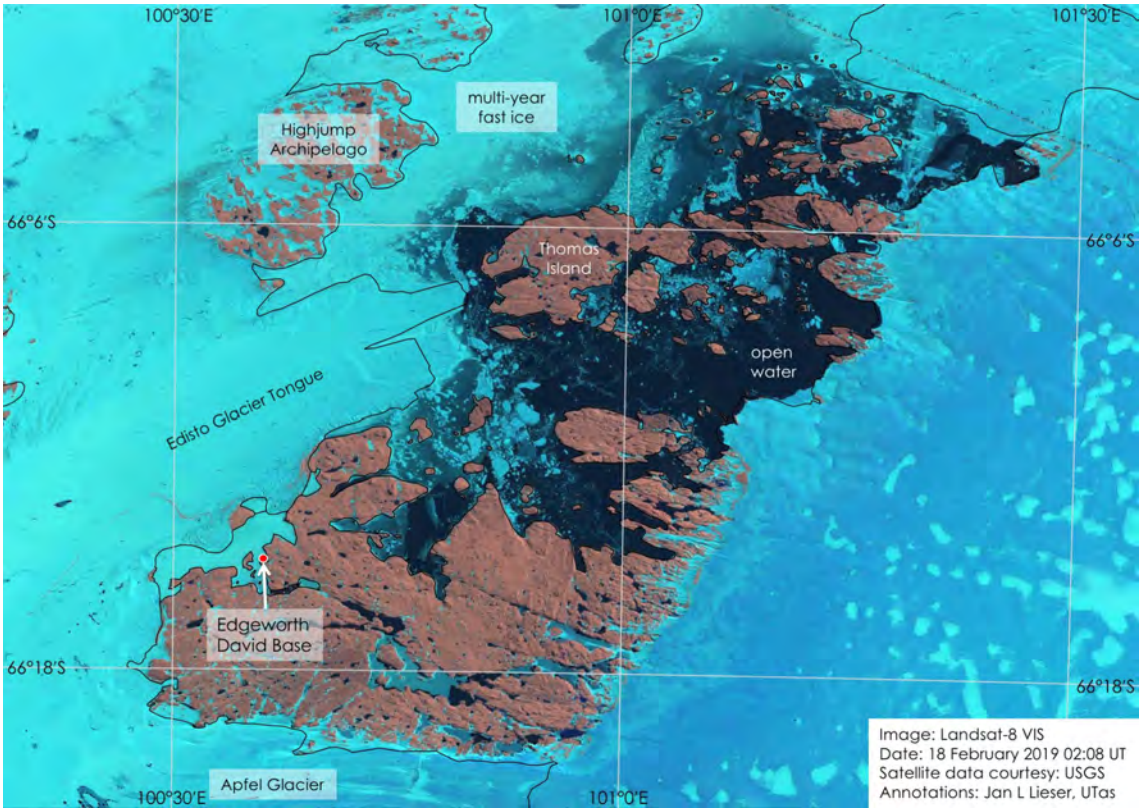

Figure 1: *Landsat-8 VIS acquired 18/02/2019 at 02:08 UT and provided by USGS.*

The amount of open water patches in between the hills is still increasing (see Sea Ice Report #07.4/2019 for comparison). Figure 2 shows a visible scene of the same frame as Figure 1 but for 19/02/2019 and Figure 3 shows the same frame again, but high-resolution SAR data acquired on 20/02/2019.

Prevailing wind conditions have pushed broken ice further west while it is still melting. The open water between the hills is now relatively free of drifting ice and the ice edge is marked by red lines in Figure 3.

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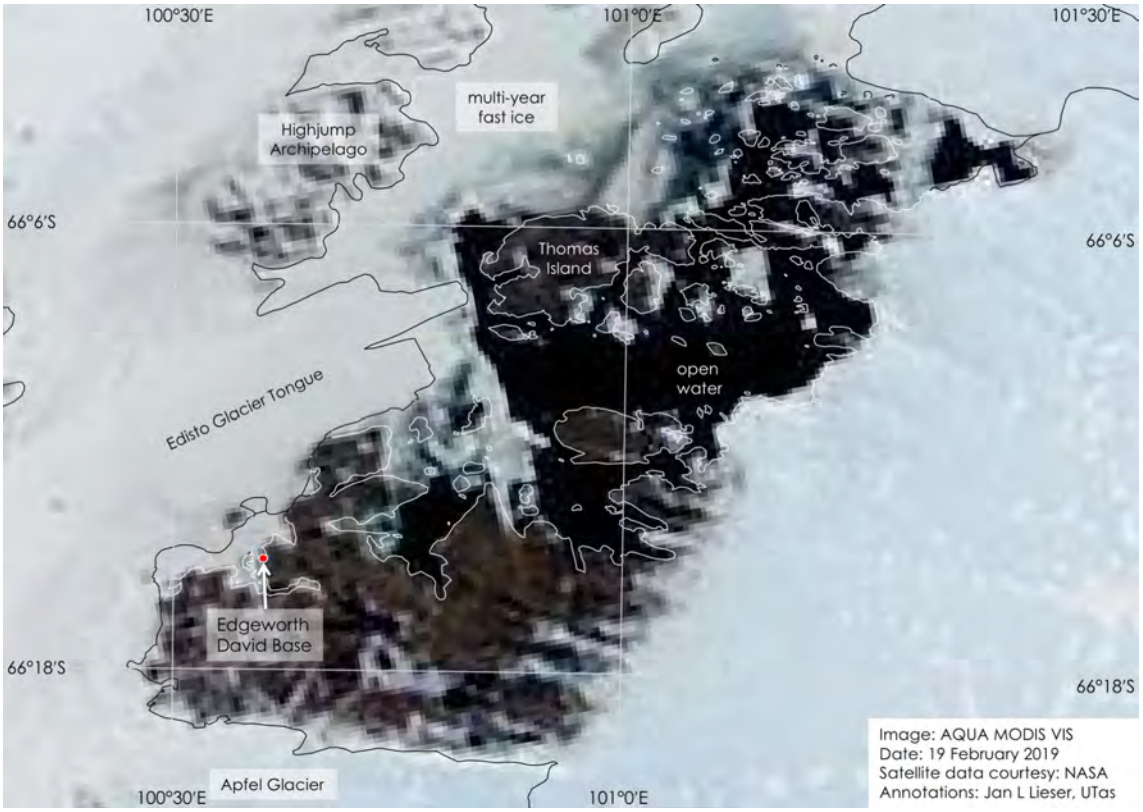

Figure 2: *AQUA MODIS VIS acquired 19/02/2019 and provided by NASA.*

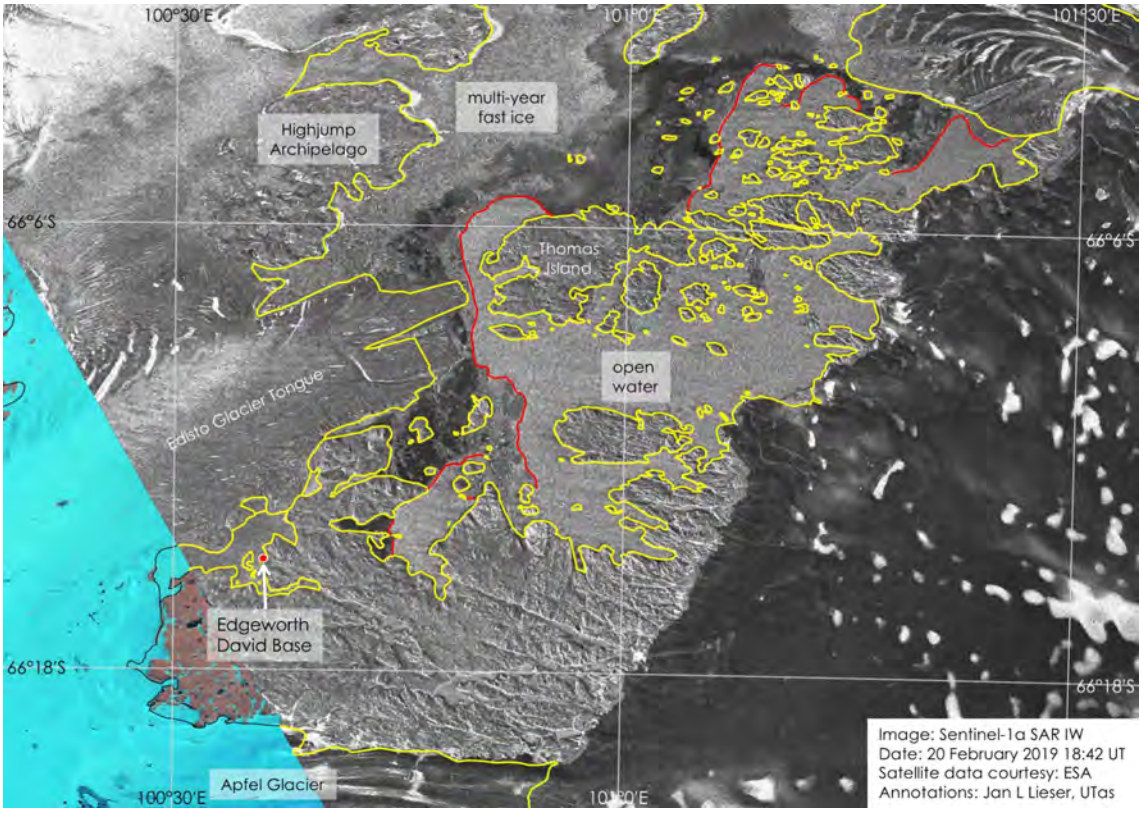

Figure 3: *Sentinel-1a SAR IW acquired 20/02/2019 at 18:42 UT and provided by PolarView; complemented by Landsat-8 VIS data (see Figure 1).*

Sea Ice Report #09.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
25/02/2019

D'Urville Sea

Figure 1 shows a sea-ice concentration chart of D'Urville Sea. The cruise track of RV *Investigator* (callsign: VLMJ) is given as a blue line (up until 25/02/2019 01:30 UT). North of Cape Denison, the positions of four large icebergs are marked by pink outlines.

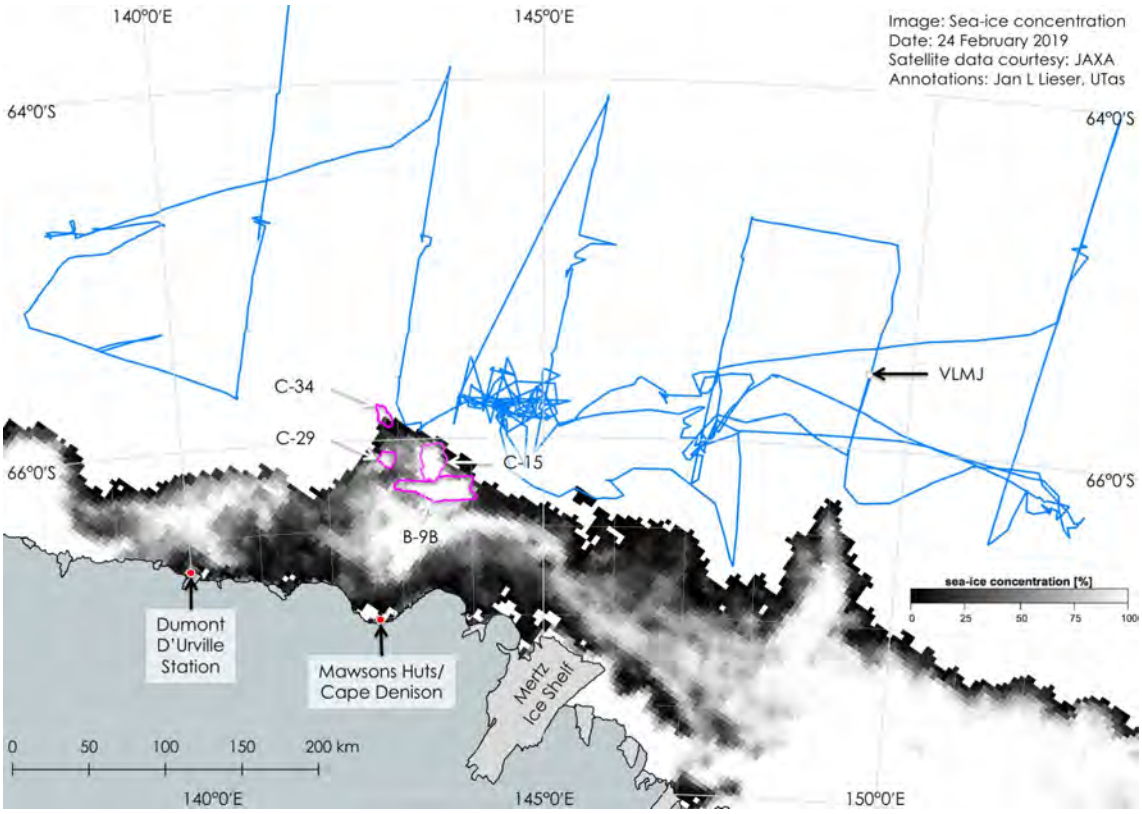

Figure 1: *Sea-ice concentration data acquired 24/02/2019 and provided by Universität Hamburg.*

Immediately west of the Mertz Ice Shelf, some new sea ice starts forming nearshore and is quickly transported westward towards Cape Denison. However, the majority of sea ice in the region is still decaying older sea ice, which is predominantly originating from the reservoir east of 148° E and drifting westward with the coastal current (except for fast ice west of 138° 30' E). The number of icebergs remains high in the area.

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Sea Ice Report #09.2/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
27/02/2019

Halley VI Station

Figure 1 shows a panchromatic image of the Brunt Ice Shelf (terminating in the Weddell Sea).

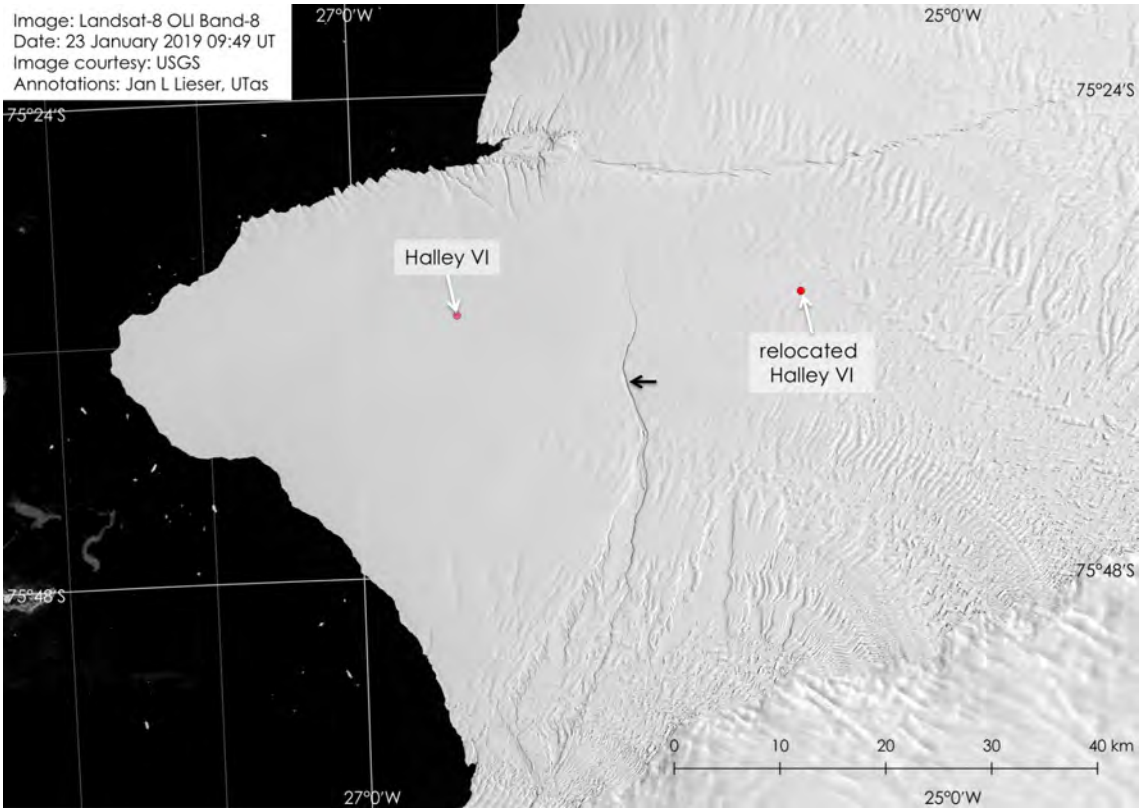

Figure 1: *Landsat-8 OLI Band-8 data acquired 23/01/2019 at 09:49 UT and provided by USGS.*

Two major cracks through the Brunt Ice Shelf, which were of concern for Halley VI Station in 2017, have propagated further. Since October 2017 (refer to Sea Ice Report #45.1/2017), the station has been relocated and the large, north-south oriented crack has advanced more than 10 km northward (roughly from the location of the black arrow), and the east-west oriented, so-called 'Halloween Crack' has extended eastward at least 3.5 km, while the entire shelf has moved westward roughly 1 km. Depending on the final developments, the to-be-expected iceberg can be larger that 1500 km^2 (larger than Flinders Island).

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Sea Ice Report #09.3/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
01/03/2019

D'Urville Sea

Figure 1 shows a SAR scene of D'Urville Sea.

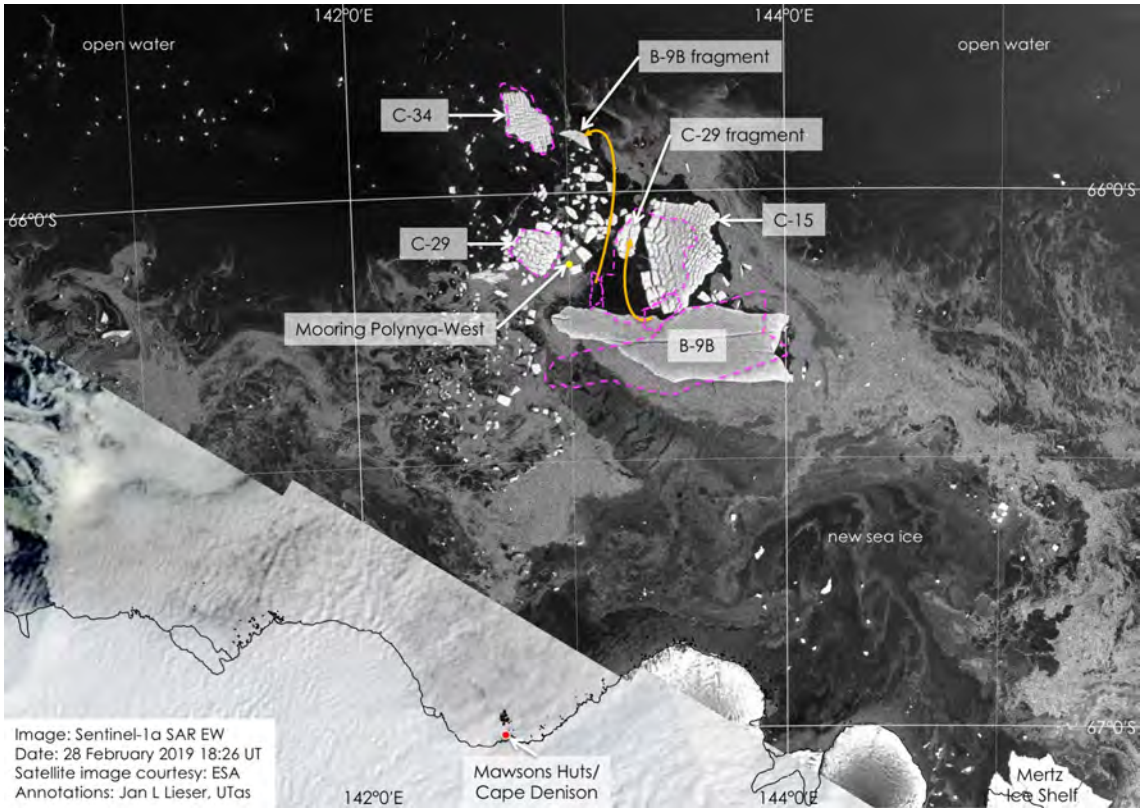

Figure 1: *Sentinel-1a SAR EW data acquired 28/01/2019 at 18:49 UT and provided by ESA; complemented in the southwest by AQUA MODIS VIS data acquired 28/02/2019 and provided by NASA.*

New ice formation has started in the region, while some of the icebergs north of Cape Denison are still mobile and moving generally in a northward direction. The respective positions of four large icebergs and two identified iceberg fragments on 04/02/2019 (refer to Sea Ice Report #06.4/2019) are marked by dashed outlines in the figure. The paths of a fragment of iceberg B-9B and a fragment of iceberg C-29 are marked by orange arcs. Iceberg C-34 exhibits signs of weathering and is shedding ice at its edges, particularly the northern edge.

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Sea Ice Report #11.1/2019

by the Sea Ice Service* of the
Antarctic Climate & Ecosystems Cooperative Research Centre and
Antarctic Gateway Partnership

Analyst: Jan L Lieser
12/03/2019

Antarctica

Figure 1 shows a sea-ice concentration anomaly chart for February 2019.

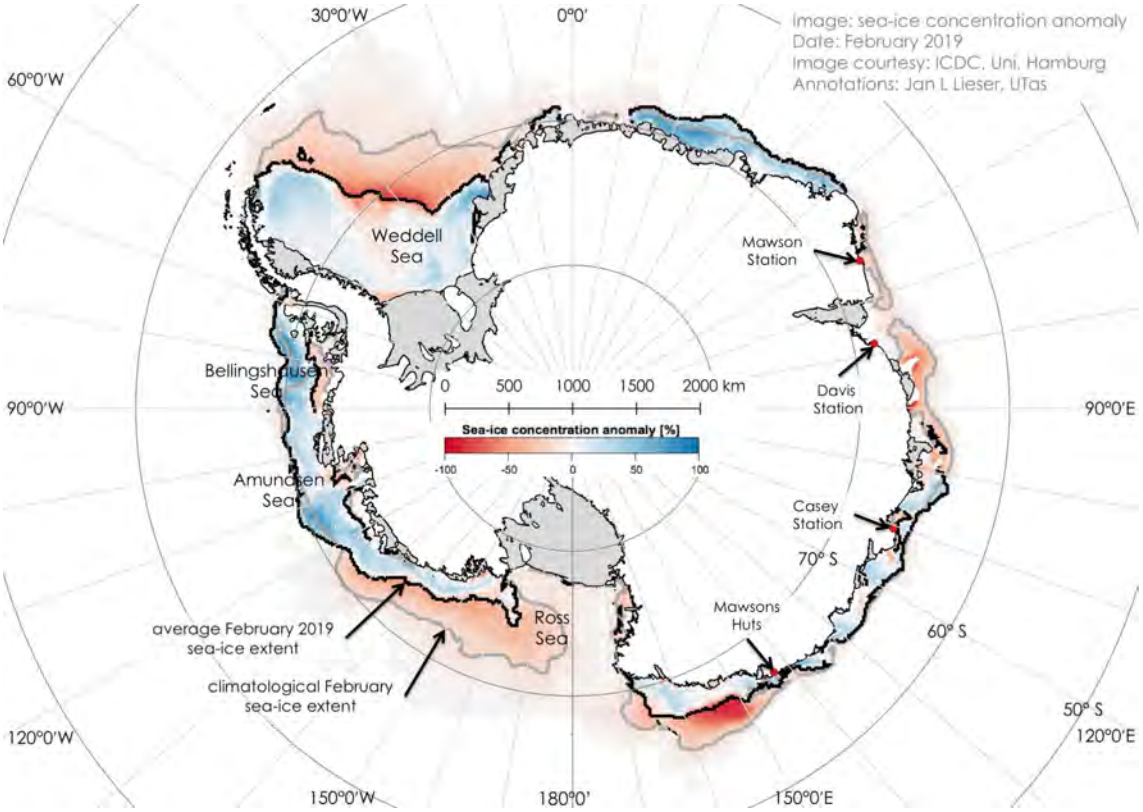

Figure 1: *Sea-ice concentration anomaly for February 2019 provided by ICDC, Universität Hamburg.*

In February 2019, sea-ice extent remained largely below average (relative to 1992-2018) conditions throughout Antarctica, except for a small region between 10° E and 50° E. Parts of the Bellingshausen Sea and Amundsen Sea showed close to average February conditions.
In East Antarctica, low sea-ice extent was accompanied by below average sea-ice concentration west of 100° E toward 50° E and mixed (above and below) concentration within average extent between 100° E and 140° E.

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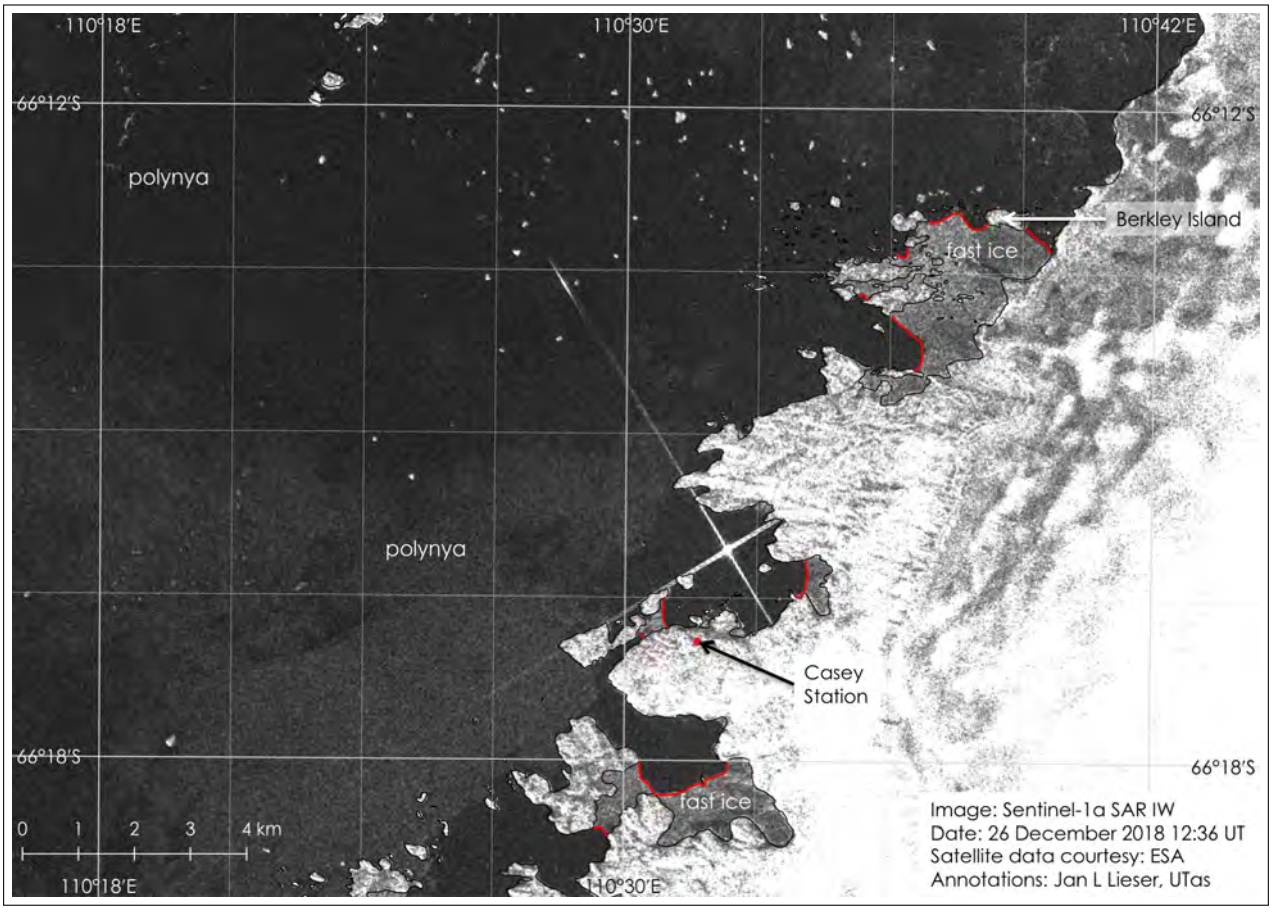
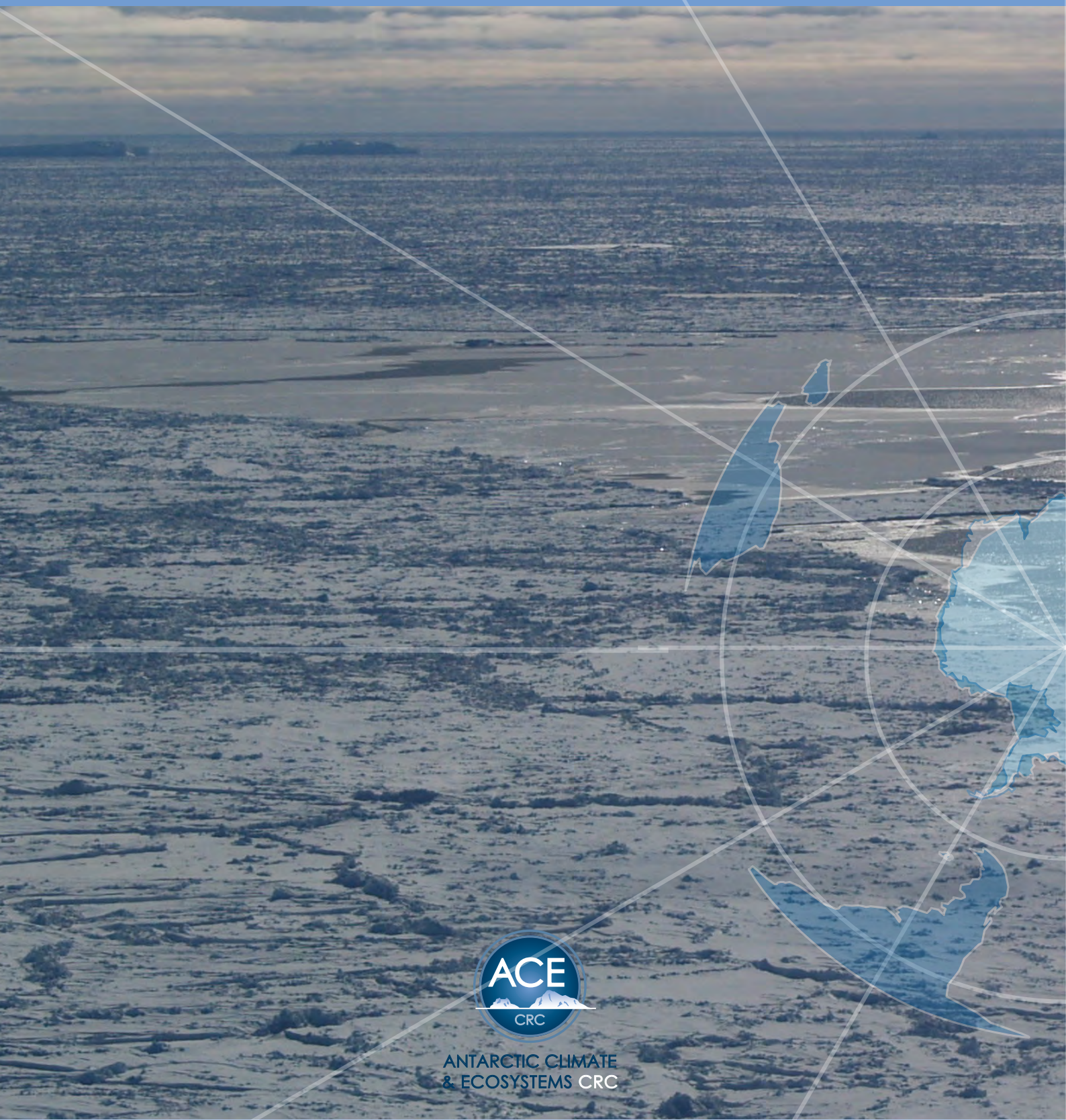
About the author:

Jan L Lieser

Dr Jan L Lieser is a meteorologist and marine glaciologist with the Antarctic Climate & Ecosystems Cooperative Research Centre and the Antarctic Gateway Partnership at the Institute for Marine and Antarctic Studies of the University of Tasmania.
Jan is the leader of the Sea Ice Service at the University of Tasmania and his research interest is polar remote sensing with a focus on airborne imaging techniques using digital aerial photography and scanning LiDAR to estimate sea-ice thickness. He has also researched on-site polar meteorological observations and sea-ice geophysical properties, as well as numerical modelling of Arctic sea ice and Antarctic subglacial Lake Vostok. He was a wintering scientist at the German Neumayer Station and has participated in several field research programs in both Antarctica and the Arctic Ocean, conducted by the university's research partners, the Australian Antarctic Division and the German Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research. Jan has spent more than 450 days at sea, on-board icebreakers.



In Newcomb Bay (off Casey Station), the star-shaped signature is caused by RSV Aurora Australis and a result of a 'perfect reflector' being hit at an ideal angle (with respect to the space-borne SAR instrument) at the time of the data acquisition. Sentinel-1b SAR IW scene provided by PolarView.



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